ELECTRONICS Australia

HIFI NEWS

DECEMBER 1973
AUST 60c* NZ 75c

ELECTRONICS IN NEXT YEAR'S CARS

BUILD NEW QUADRAPHONIC AMPLIFIER, 200MHZ COUNTER

Registered for posting as a periodical — Category B

How about some system in your house?

This is *some* system—a Sony hi-fi music system of spine-tingling, toe-curling realism. When the sheer excitement of Sony's superb rig surges through your Sony headphone and enchants your eustachian tubes you'll really rave. There's 75W (RMS) per channel for all the power you'll ever need from the gleaming Sony TA-1130 amp. Sony's TC-161SD Dolby tape deck has exclusive "Ferrite and Ferrite" heads, closed-loop capstan drive and frequency response 2 Hz-17,000 Hz with C202 tape. The PS-5520 belt drive turntable with magnetic cartridge gives flawless reproduction and the SS-7200 Ultra-Linear 3-Speaker system enclosures handle 75W power with such fidelity, the singer's breath fans your face.

SONY®

Distributed by JACOBY KEMPTHORNE SERVICES

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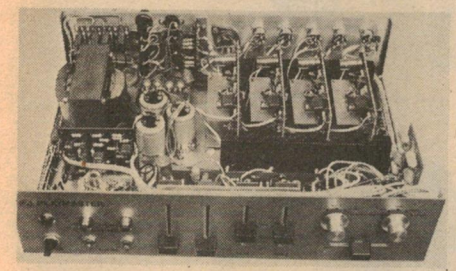
JK5963 **For further information please fill in the Reader Service coupon in this issue.**

ELECTRONICS Australia

Australia's largest-selling electronics & hi-fi magazine

VOLUME 35 No 9



Thinking of converting to four-channel? Our new Playmaster 140 will let you do so very economically, despite its very impressive performance. It offers 16 watts per channel, full control facilities, inbuilt decoders for matrix, and provision for discrete input signals. See the article starting on page 30

Our new digital frequency counter design measures to beyond 200MHz, yet is easy to build, simple to operate and far lower in cost than a ready-made counter.

SPECIAL HI-FI FEATURES in this issue include the latest news from the manufacturers (page 28), the story of four big hi-fi equipment reviews starting on page 105.

On the cover

The new Philips VLP video disc player, as demonstrated at this year's Berlin Radio and Television Exhibition. Using laser readout from 30cm discs, it seems a strong contender in the home video stakes. (Courtesy Philips Industries Ltd.)

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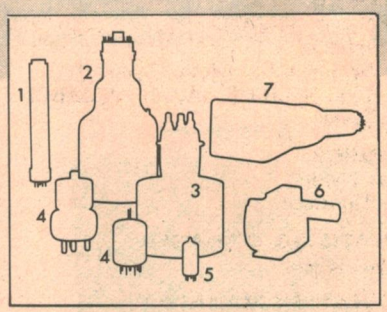

Talking Tubes? Say Philips

1 Camera Tubes. Over 80% of the TV cameras in the world use the Philips Plumbicon* camera tubes. These tubes are renowned for reliability and picture quality and were developed to meet the most stringent requirements imposed by designers of high quality television broadcasting cameras.

2 Photomultiplier tubes for Spectrophotometry and Scintillation counting.

3 R.F. Power Triodes for industrial heating (390W-480KW) and for communications (390W-360KW).

4 R.F. Power Tetrodes for communications (10W-17.6KW).

5 Special quality tubes designed for applications where reliability during life is of prime importance.

6 Microwave tubes for communications, radar and R.F. Heating.

7 Cathode Ray tubes for Oscilloscopes, Measuring instruments and Video display terminals.

* Registered Trade Mark for television camera tubes.

Application books on Photomultiplier Tubes and Tubes for R.F. Heating are available from ELCOMA, P.O. Box 50, Lane Cove, N.S.W. 2066

For full information, specifications, etc., contact:

ELCOMA

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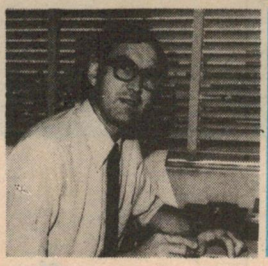
PHILIPS

153·11



EDITORIAL VIEWPOINT

Disappointment on the small screen . . .

Tune in to almost any commercial TV station lately, in the hours just before or after school, and you'll find children's programs largely composed of either third-run repeats or imported animation films heavily laced with violence. The gaps between the films will as likely as not be filled with countless commercials stressing the need for possessing the latest toys and confectionery extravaganzas, interleaved with "live" segments in which a junior announcer presents other commericals thinly disguised as quizzes and giveaways.

Quite apart from the abysmally low cultural and intellectual level achieved by these programs, there is the apparent complete lack of concern for the possible dangers to young minds — and not just from the violence. Do we really know what effect highly persuasive commercials have on the young child? Perhaps it is not just coincidence that modern children seem more greedy, materialistic and harder to amuse than previous generations.

We have been sufficiently worried about cigarette commercials to phase them out, but there may be more subtle aspects of television which in the long term could be even more dangerous.

It is not only commercial television which falls short, though. No doubt most of us have been at least irritated, at one time or another, by ABC discussion programs in which the sole aim seems to be to fill up half an hour or an hour of program time, and not to discuss the topic itself at more than superficial level. Even the recently initiated "open-ended" programs seem but a token effort to deal with this shortcoming.

For thousands of years, mankind simply had no means whereby information could be communicated rapidly over vast distances and to large numbers. Now, as a result of considerable creative and industrial effort, we at last have such a means. It seems ironic that much of the time we use it for such dubious purposes as brainwashing our youngsters into coveting the latest toys and lollipops, or attempting to persuade ourselves that complex subjects like marriage and abortion can be thoroughly discussed in a brief hour of interviews, telephone calls and soul songs.

Anyhow, . . . enough pontificating. It's not long now until the festive season. All of us here at Electronics Australia wish our readers a very happy Christmas, and a prosperous new year. May all your problems be little ones, and not caused by our projects!

— Jamieson Rowe

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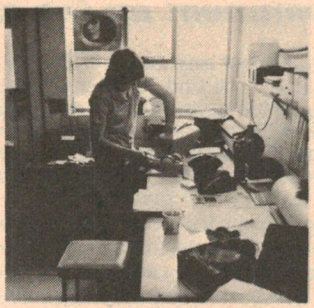
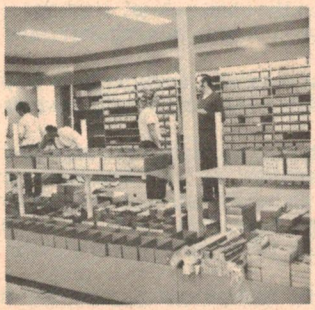
Dick Smith Ele

Dick's New Centre Opens

It is the most advanced store of its kind in Australia. Dick toured the world to see all the very latest ideas in self-selection etc. Discussed methods with similar organisations overseas. Now you can see the result at 162 Pacific Highway, Gore Hill. If you were put off by our old cramped shop alongside you'll want to spend days in our new place. It's enormous and fully air conditioned!! Most of the goods are on self-selection to save your time (and money). We even let you write your own dockets out!!
Counter staff are on hand to advise you. Other innovations include:





FREE valve testing service. Dick has the very first Mercury valve tester installed. Fresh from the USA, this is an automatic Pass / Fail tester you can operate. Just bring the valve in and test it for free. Then we have replacements at TRADE prices. This new service has proved very popular with users of the Telefix calculator ($2.00) since you can service your own TV set for a fraction of the usual cost.
New Demonstration Lab. Right by the entrance is a demonstration room where we will be having displays of interest to everyone (send in your suggestions and suppliers note too). We are trying to arrange for the new ETI Synthesiser to be demonstrated for example, as well as some of the very latest test gear. Watch our ads for advance information on these FREE displays.
Noticeboard. We don't just want to sell you stuff, we want to help you swop yours, ideas etc. So we've installed a noticeboard where you can for a couple of weeks advertise at no charge (naturally we won't be responsible for the outcome and we have a few reservations on what can be put up!!).
Special Hi-Fi area. Our demonstration room will be about the same size as an average room at home so you can get a really good impression of what the gear will sound like. There will also be an area where you can just look and compare.

New streamlined mail order department. This was opened just in time to cope with the avalanche of mail after our new catalogue and the mail dispute at Redfern. Those of you who have tried our new Mail Order Form tell us that it is extremely easy and clear — especially the Back Order section. Such is the volume of our business now that we are finding that your order may take up to a day in our system. (We know this because we log the progress of every order through the system). Other firms may claim to be faster, they just don't handle the same volume!! Next month we'll tell you more about the premises, meantime if you're in Sydney, call in. It's definitely worth a visit (rivals the Opera House some say!!)

Educational kits prove extremely popular at this time of year. All components are reusable so there's hours and hours of fun and no soldering or technical knowledge is needed.
Crystal Radio kit an all time favourite enables local stations to be picked up without battery. Assemble your first radio in under an hour for $4.95 (P&P 30c).
10 in 1 includes a solar battery and enables several radios, signal generator and morse code oscillator etc to be built. 10 projects in all for only $8.95 (P&P 50c).

50 in 1 Solar Energy kit gives 50 experiments using relay, transistor, transformer meter etc. Requires two batteries. With 58 page manual $21.95 (P&P $1.00).
150 in 1 The Ultimate kit (see ET review) A magnificent kit in wooden case with enlarged visualised IC, radio tuner, CdS cell, transformer etc. No soldering so you can build the circuits up over and over again — and some of your own. Beautifully presented in 16" x 8½" x 3½" case at $35.95 (P&P $2.00).

Headphones

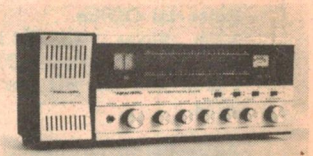
Headphones P&P 50c Prices to suit all pockets. Headbands to fit all heads (even big ones). **SA32D** our cheapest with 300mW rating, frequency response from 25 — 18000Hz $5.95.
SH850GX a higher powered model with wider frequency response. Supplied with cord and stereo plug $10.95.
AD38SL ideal for professional users, very comfortable has built-in independent volume and tone controls plus stereo-mono switch. 20-2000Hz response $14.95.
Pioneer SEL20 very compact and light weight. Unique open back design for better sound dispersion. Uses new ultrathin polymer film diaphram $23.15 (P&P $1.00)

Pioneer SE50 really are the best having a 3" cone type element for rich bass and a horn tweeter (just like a loudspeaker system). Level and balance controls built in. Well worth $46.00 (P&P $1.00).

NEW NEW NEW

New, new Dick has Guaranteed calculators
We are now stocking the "Advance" range of electronic calculators. Don't be put off by the prices — just add $20 to $30 to get the true value. We sold the first trial shipment in two days!!
1200 Ruby has a digit display with 12 digit capacity. Selectable decimal point. Does all the usual calculations including chain multiplying etc. Runs from 9V transistor battery. Bright easy to read LED display. We save you around $10 at our ridiculous price of only $59.
8012 Grantham is a desk top job with floating decimal. Operates from 240V with constant key, overflow indication, leading zero, suppression and 8 digit display $79.00.
1211 Grantham is the cheapest anywhere with a full memory. 12 digit display, constant and percentage key. Clear entry key, Truncate switch and decimal point selectable to 8 places. And it's yours at our knock out price of $115.
Note all these calculators are available on our normal money back guarantee terms. Why not try one at our expense for 7 days. ALSO THEY HAVE FULL 3 MONTH AUSTRALIAN WORKMANSHIP GUARANTEE. Send now you can't go wrong!!

New Realistic with FET Front End at old price
Has over 30 semiconductors tunes in SW CW SSB / AM Broadcast etc right from 600kHz to 30MHz. Operates from 12V — use one in your car! Variable BFO, Cascade RF stage. 240V ac operation or batteries. Recommended at $225 (P&P $3.00).



STOP PRESS. Digital counter, E.A.Dec Complete kit inc. crystal, case and readouts. 20MHz $116 (P&P $2.00) With Prescaler giving 200MHz capability $135 (P&P $2.00)

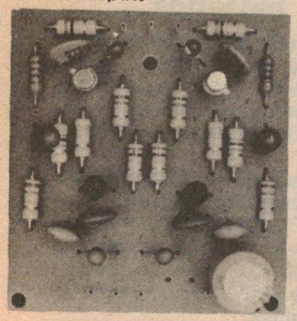
Dick Smith Electronics Pty Ltd 160–162 Pacific Highway, Gore Hill NSW 2065. Phone 439 5311

ctronics Centre

MAG PRE-AMP

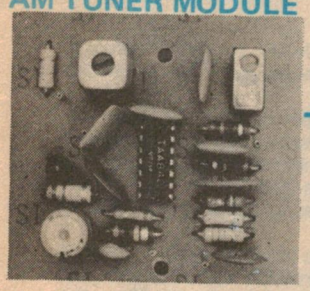
A complete magnetic pre-amp on a 13/16" x 2 1/2" printed circuit board, packaged in a transparent plastic bag with instruction sheet. The circuit contains 2 high gain transistors per channel to provide the excellent performance that potential users will want.

Brief specifications:
Frequency response within 1dB of RIAA curve from 30 Hz to 20 KHz.
Sensitivity is 2mV for 150mV output at 1 KHz.
Input impedance is a nominal 50 K.
Noise is typically -68dB.
Distortion figure; less than .04% THD at 250mV and 1KHz output.



Ready to use $12.50 (P&P 50c)

AM TUNER MODULE



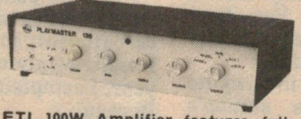
Brief specifications:
Tuning range 510-1625 KHz. Output 750 mV into 100 K. Power supply 7 to 9V DC, 20 mA from battery etc.

Module only (needs ferrite rod and capacitor) $13.20
Rod aerial $2.50
Tuning gang $3.60 (P&P 50c)

Expo Amplifiers are very popular representing value in the medium price bracket. Come in and hear one — you'll be pleasantly surprised and so will your bank balance.
KA205 has 12Watt RMS output, handles radio, disc, tape inputs etc. Full range of controls and is housed in a deluxe walnut cabinet at only $65 (P&P $2.00).
TA3100 has an output of 25Watts RMS uses transformerless input and output stages, has 20 transistors. Scratch filter incorporated. Full 20-40000Hz response. Hand-rubbed walnut cabinet $89.00.
SCD77X Cassette Deck is ideal for adding to your stereo set-up. Beaut looking with slider controls. 2.5V output suits most Amps. Frequency response from 45-12000Hz $119 (P&P Road freight extra).

Holiday time is ideal for knocking up a kit (they also make ideal presents). Here we list our most popular. First the Dick Smith "Superkits." These have been specially selected for the VIP treatment. Prototypes have been built and evaluated and we include comments and suggestions for improvement over original specs. You also receive reprints of articles and corrections. Most have flow-soldered P.C. Boards and extras that we think will help you to get a Super finish.

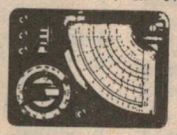
Playmaster 136 Amplifier. Without doubt the most popular amplifier kit we have ever handled. Compares favourably with commercial units. Has expensive brushed aluminium panel. We also include silicon grease to improve thermal conditions in output transistors. Less Fairchild Special offer transistors $55.60 (including transistors $65.00) Both P&P $1.00.



ETI 100W Amplifier features full 100W RMS output. Prepunched heatsinks and silicon grease plus heat dissipating paint. Sturdy metal case. Ideal for guitar enthusiasts. Simplified instructions included $65.00 complete (P&P $1.50).
100W Pre-Amp Kit. Produced in response to numerous enquiries to complement the above amp. Two sensitivities for mics and guitars, volume treble and bass controls. No case since most users build it into something else. Pretinned boards full circuits included for $9.50 (P&P 50c).

TEST EQUIPMENT

A wide range of multimeters from beginner's models right through to the professional FET instrument. **DSE-2** is an ideal first multitester having a sensitivity of 20,000ohm per volt. 17 ranges cover AC and DC volts, amps. Resistance and useful capacitance ranges. Complete with test leads at $12.50 (P&P $1.00).

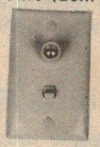


Jayem 100K is a high sensitivity (100,000ohm / volt) instrument with 51 ranges and accurate to ±3% .5" movement is easy to read and the carrying handle acts as a stand. Diode protection and built-in magnetic shield. Very popular at $39.50 (P&P $1.00).
Jayem L-55 FET VOM has a constant 10Meg input impedance. Has 27 ranges. Battery operated and supplied in handsome vinyl carrying case. 2x probe included to double d.c. voltage ranges and input impedance. $43.50 (P&P 75c).
E-Z Hooks the most tenacious test prod we know. Fast safe and trouble-free. Two types — XL-1 is extra long for birdsnesters, beryllium copper, gold-plated contacts recommended at $1.55. X-100W is a shorter version for general test use 86 cents.

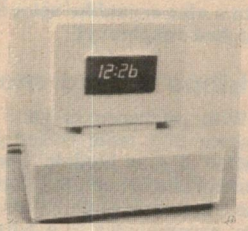
X-100W

Kits

Varilight Dimmer. Handles up to 1000W gives professional light dimming at a fraction of the cost. Includes 8A triac and posh Clipsal flush mounting plate $6.90 or electronic components only in short-form kit at $4.90 (Both P&P 50c).



Digital Logic Trainer. Learn all about digital with this beaut kit. Many sold to tech colleges, industry etc. Contains 6 JK flip flops, 2 and 3 input gates, inverters, buffers and 4-input Schmitt. These are supplemented by a dual range clock, level setting switches and LED readout. Our kit uses best components available including a handsome silk-screened panel $82.00 (P&P $1.00).
Musicolour. Watch the coloured lights dance to the sound of your favourite music. Filtered bands of audio are used to trigger the lights. Complete kit includes anodised front panel and explicit instructions $52.00 (P&P $1.00).
30Watt R. F. Kit has proved popular with Amateurs. Available in 3 stages which together give 30 Watt out from 300mW in at 144MHz from a 12.6V supply. Get the complete kit (for advanced constructors) for $37.50 saving you $5.00 on stage prices.
Dick's Decision Maker. Helps you make difficult decisions just by pushing a button. Ingenious little circuit using transistor switching and LED lamps. Supplied with silver label and tough plastic case to fit your pocket. Only from us at $8.75.



Car Burglar Alarm (E.A. Sept 73). Protects everything on your car except the driver. Yes even roof racks. Ideal for beginners, $17.95.

Electronics Australia and Electronics Today Kits.
These kits use the same high standard components as our Superkits but are presented without added refinements. We use no reject or inferior parts, manufacturers seconds etc. We are too anxious to preserve our reputation!!
Playmaster 131 Tuner (E.A. Feb 71) still very popular uses TAA840 IC and is supplied with handsome matt black scale card. $23.50.
Signal Generator (E.T. June 71) gives sine and square wave output in range 15Hz to 150kHz. Case included $24.50.
Transistor Tester is very easy to build with our 3" movement. Looks professional with de-luxe satin panel, diecast case etc. $14.50.
Mic Pre-Amp. (E.A. March 72) suits all mics, has adjustable Bass response to improve performance. Another easy one at $3.30.
LED Indicator (E.A. March 72). Ideal for checking audio signals. Used by many groups to check out mixers, amps etc. $3.10.
20W P.A. Amp (E.A. June 72) uses the TA20C module, has mixing inputs and gives 20W RMS supplied with engraved front panel and case. Ideal guitar practice amp $57.00.
Reverb Unit (E.T. 25 Top Projects) as featured in our catalogue. Improves sound of most instruments enhancing natural decay of sound. Complete with Plessey Spring Unit $36.00.

Signal Injector (E.A. June 73). Almost as useful as a screwdriver. Uses 2 transistors and will do AF and RF work. Essential piece of basic test gear. Complete with handsome probe case $6.25.
Stereo 2-4 Adaptor. The easiest way to sample 4-channel is this simple decoder from Nov 72 E.A. Knock one up for only $5.75.

Sperry Digital Clock Kit (E.A. Sept '73) Based on the Sperry Gas readout and National integrated circuit, this kit provides full 24 hour mains operation. All parts are included in the kit except the metalwork (we thought you'd prefer to make your own). Full kit **$49.00** Special Sperry/National offer of readout, IC and transistors only **$28.75** (Both P&P 50c).
Headphone Adaptor (E.A. Aug '73) provides two sets of headphone outputs or speakers or both to be operated simultaneously. Separate left and right control from this very versatile unit. Full circuit details included etc. **$18.95.**

It's not just a price list. In fact you could hardly call it a catalogue. 64 pages jam-packed with information. 20 pages of data alone. Just check some of the contents:
- **P25,26,27 Inside circuits and connections of 43 popular digital ICs.**
- **P26,29,30 Descriptions, circuits, applications of 6 popular Linear ICs.**
- **P50,51,52 Test gear to enable you to build a full scale lab.**
- **P48,49 Tools and more tools. All the things you can't get, we've got on this spread.**

Simply send 30cents to cover Post and Packing and we'll send you the 50cent catalogue, plus 50c vouchers by return. Remember it's a 64 page catalogue with over 20 pages of information, specs etc. Send now to avoid disappointment.

Dick please send me your Free catalogue. I enclose 30 cents towards post and packing.

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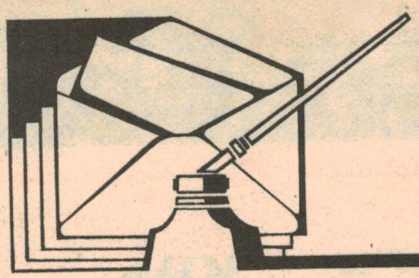

LETTERS TO THE EDITOR

The views expressed by correspondents are their own and are not necessarily endorsed by the editorial staff of "Electronics Australia". The Editor reserves the right to select letters on the basis of their potential interest to readers and to abbreviate their contents where this appears to be appropriate.

Never on a Sunday

Some people think they have problems when switching tones come down the mains. What about this one, from the London "Daily Telegraph", Sept 5, 1973:

"The electronic organ in the tiny church of the Royal Naval Air Station, Yoevilton, Somerville, kept playing notes when no one was near it — but never on a Sunday.

"An engineer called in to investigate found that beams from the station's revolving radar scanners were being picked up by the components in the organ, which produced notes.

"A spokesman at the station said yesterday: 'It never happened on Sundays because the scanners were switched off'. An anti-interference device has now been fitted to the organ."

(A. Smales, Konedobu, PNG)

COMMENT: Radar scanner interference isn't news in the "Electronics Australia" laboratory. The big dish on the far side of Sydney airport squirts interference through a lot of the audio gear we get on the bench. Not a nice organlike note, either, but a high pitched raspberry!

Philips sound modules

With reference to your article in your August 1973 issue (refer page 102 Philips SM130 "Sound Module") we felt it may be worthwhile to point out that the principle of the "Sound Module" does not really bear any resemblance to a normal loudspeaker enclosure to the extent of just replacing a paper cone with polystyrene foam diaphragm.

The Philips SM130 sound module is a transducer of radical design whose principle of operation is such that a substantial mass of air is not required in front or behind the diaphragm which is the essential component of the trandsucer. As you may know, the diaphragm comprises a panel of polystyrene (acoustic polymer) which has been pre-stressed and shaped in such a manner that vibrations from a voice coil applied to the rear of the panel, move through the panel in a direction at right angles to the planar surface and are then diverted in a direction perpendicular to the original direction and decompose on the surface of the panel, thereby providing the sound. In addition this principle provides for omnidirectionality thus enhancing the products' objective of "place it anywhere to suit your decor" without any real sacrifice of stereo separation.

We trust these comments may be of interest to your readers.

A. Rievwers,
(Product Manager HiFi)

COMMENT: The wording of our report, we believe, indicates that we were aware of the special nature of the radiating surface. At the same time, we implied that this general class of transducer lacks the wherewithal to isolate front and rear radiation at low frequencies. That implication still stands.

"Leakproof" batteries

I had, for some years, been infuriated by the obvious falsity of the word "leakproof" on batteries, so when I found two of them leaking in my cassette recorder early last year, I complained to the Consumer Affairs Bureau.

It took the Bureau a while but they finally achieved a most worthwhile result.

At this stage, my main reason for writing is to set an example to my fellow citizens; to let them know what they can do just by using existing law. Mr Average isn't as powerless as he thinks.

The letter from the Consumer Affairs Bureau is attached.

N. A. Roberts (Chatswood, NSW).

Dear Sir,

I refer to your letter of 27th February, 1972, and to your subsequent letter of 25th June, 1973.

I advise that the matter has been investigated by Inspectors of the Department and the firm concerned has voluntarily agreed to remove the term "leakproof" from their batteries and this is now well in hand.

It may be some months before current production is cleared through retailers but, in view of the attitude taken by the firm, the Bureau does not propose to take any further action at this stage.

I would like to take this opportunity to thank you for bringing this matter to my attention.

Signed on behalf of
P. H. Gallagher (Commissioner for Consumer Affairs, NSW).

COMMENT: While your complaint undoubtedly set things in motion locally, it is in line with world-wide action to outlaw descriptions which may not be strictly true in all circumstances. We understand that "leakproof" is one of many such words which are virtually banned in the United States and foreign dry cells will not be admitted for sale if they are so marked.

Type numbers

The main reason for this letter is concerning the labelling of components. At the moment this is disgraceful, as component values are getting harder and harder to

decipher from the mass of figures presented. A recent case that comes to mind concerns the labelling of a 100pF ceramic disc capacitor, labelled 750 101J.

When I received the capacitor with my order, I thought that it was a 750pF unit and that the supply company had made a mistake. So I ordered another 100pF capacitor, and a week later received the same type with the same numbers.

Do we all have to have special codes to decipher these values? This is totally ridiculous as the value should either be plainly stamped on it, or it should be in the form of a colour code.

In my opinion it would help everyone in the business if there was some standardised form of indicating the values of components easily.

L. Schier (Croydon, NSW).

COMMENT: We can understand your frustration and we have often felt the same way. The fact is that most components are made for bulk consumption rather than over-the-counter sale and a coding system may provide more positive identification for stock and planning purposes. With computerised stock control, the numbers can become even more tedious to mere humans!

Power with safety

In answer to the letter headed "Frayed Cords" by L. Junor (Diamond Creek, Vic.) which appeared in the September issue of Electronics Australia in your section "Letters to the Editor," I am pleased to supply information concerning a recently developed "Safety Checker."

Being very aware of the great need for a means of testing portable electric tools and flexible extension cords for safety, a unit has been developed in South Australia by the Department of Further Education at Kilkenny Technical College. The unit will simultaneously carry out the following three tests, but will not discriminate between the tests as any one fault will render the equipment inoperative or unsafe:—

1. **Earth wire:** Conductor must be correctly connected and capable of carrying 25 A for 5 seconds.
2. **Open circuit:** Any open circuit renders the equipment or flexible cord inoperative and the unit will show "Faulty" so that repairs will be required by authorised personnel.
3. **Insulation:** Test is made at twice normal operating voltage and selected values of say 2 M to earth may be chosen to indicate "Safe" operating condition.

The test unit was primarily developed for use in Technical Colleges and Schools where the safety of electrical equipment is of vital importance, however, its use in a much wider field is visualised.

The equipment is being manufactured by Parameters (S.A.) Pty Ltd and a number of units are now in operation.

A.P.B. Coward, Headmaster, Elec Tech, Kilkenny Technical College.

Now you Dolby...*

TC-134SD

With standard low noise Sony cassettes, reproduction from these models is superb. With Sony chromium dioxide cassettes it's sensational!

TC-129

now you don't!

Sony comes on strong with two superb stereo cassette tape decks with Ferrite and Ferrite heads.

Sony unveils its new TC-129 tape deck as a perfect companion to the immensely popular TC-134SD deck! Both have Sony's precisely engineered Ferrite and Ferrite head for fully extended frequency response, excellent signal-to-noise ratio and up to 200 times the life of conventional heads. Both have tape selector switch for optimum adaption from conventional tapes to CrO_2 tapes such as Sony's chromium dioxide cassette tape. Both have manual control stereo recording sliding-type recording volume controls for each channel and dual motor for easy balance control. Both have instant stop mechanism with locking pause control. Both have mechanical/auto stop which automatically shuts the tape transport off when the tape reaches its end. Each has 3-digit tape counter with reset button; headphone jack to accept 8-ohm impedance; microphone jack for MIC/LINE; REC/PB connector. Both are superbly styled. Then what's the difference—apart from their physical layout? Frequency response on the TC-129 is 40Hz-12000Hz with normal tape. 40Hz-14000Hz with CrO_2 tape. On the TC-134SD it's 30Hz-15000Hz normal tape, 30Hz-17000Hz with CrO_2 tape. The TC-129 has its own hinged detachable dust cover. The 134SD has the famous Dolby system to extend response and reduce tape hiss. Both are fantastic value. The choice is yours.

JACOBY KEMPTHORNE SERVICES

SYDNEY: 26 2651, MELBOURNE: 329 6866, ADELAIDE: 93 2338/9, BRISBANE: 44 4488, PERTH: 81 3422, LAUNCESTON: 25 322, CANBERRA: 95 2100. Agents: NEWCASTLE: 61 4991, FAIRY MEADOW: 84 8022.

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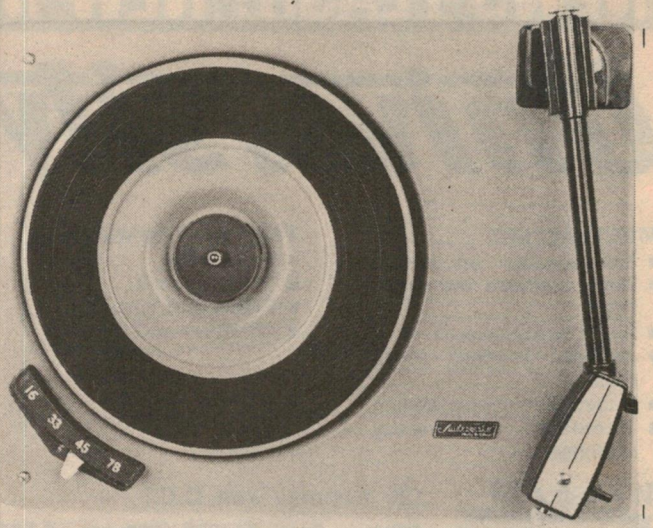
JK5967

ELECTRIC CAR FAN

Latest model electric car fan, which plugs into the cigarette lighter on your car; has 4" blades. The base acts as a suction cap to fix it to your dash; also bracket for mounting on wooden base. Available for 6 volt and 12 volt cars. Specify the voltage required when ordering.

Packed and posted $4.75.
Complete with wire & plug.

Order now for Xmas delivery.



THREE SPEED RECORD PLAYER

"Ambassador" 4 speed 16, 33, 45, & 78 rpm stereo phono unit, complete with Ronette pickup. Stereo ceramic cartridge and stylus for LP and 78 records. Packed ready to mount with screws and template for installation.

Instructions for connecting to amplifier or radiogram.
240V AC mains operated.

Posted NSW $16.50.
Posted Interstate $17.00.

Reduced from $25.00 as Xmas special.

Order now, limited stocks.

TAPE RECORDERS AT DISCOUNT PRICES

Book type Solid State tape recorder, operated by 2 torch batteries. Mike Records, plays back, erases automatically. Size 10½" x 6¾" x 1¼". Complete with mike and tape $19.75. Post and packing 75c.

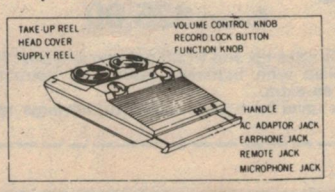
When closed looks like a book

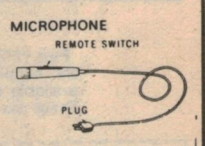
SPARE REELS OF TAPE
3" REELS
225 feet 50c.

3" REELS
450 feet 80c.

Tape Recorder TC-3000 battery operated model with mike and remote switch and tape $32.75. With A.C. adaptor for 240V operation. $45.00 complete. Packed and posted.

3¼" REELS OF TAPE
200 feet 50c
300 feet 75c.
400 feet $1.00





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NEWS FLASH! NEW MODELS!

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MULTIMETERS
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- Heavy duty robust switch
- Excellent frequency response

TEST INSTRUMENTS
- Solid State
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- Stable and accurate
- Miniature and portable

PRICE: ..... HIGHEST QUALITY at the LOWEST PRICE
GUARANTEE: 90-day, backed by University after sales service
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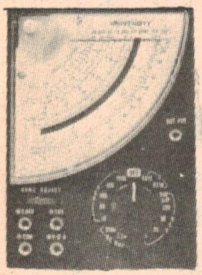
An ideal Christmas gift for the enthusiast

MVA-5 / 73

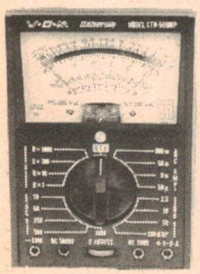


(20 Kohms / Volt D.C.)

DCV:	5/25/50/250 / 500 / 1k / 2.5KV
ACV:	10 / 50 / 100 / 500 / 1KV
db:	–20 to +68 (5 ranges)
DCA:	50uA / 2.5mA / 250mA
Res.:	Rx10, Rx1K (10 ohms to 6 Mohms)
Size:	112x87x29 mm
Weight:	285 gm
Socket:	2 mm

Price: **$12.00**

CTN500MP

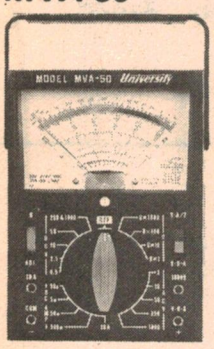


(20 Kohms / Volt D.C.)

DCV:	2.5 / 10 / 50 / 250 / 500 / 5KV
ACV:	10 / 50 / 250 / 500 / 1KV
db:	–20 / 0 / +62 (5 ranges)
DCA:	50uA / 5mA / 50mA / 500mA
Res.:	Rx1, Rx10, Rx100, Rx1 Kohm (1 ohm to 10 Mohms)
Size:	150x110x50 mm
Weight:	450 gm
Socket:	4 mm

Price: **$14.00**

MVA-50

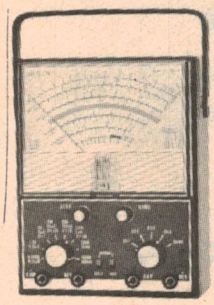


(50 Kohms / Volt D.C.)
46 Ranges!

DCV:	.25 / .5 / 1.25 / 2.5 / 5 / 10 / 25 / 50 / 125 / 250 / 500 / 1KV
ACV:	1.5 / 3 / 5 / 10 / 25 / 50 / 125 / 250 / 500 / 1KV
DCA:	25 / 50uA / 2.5 / 5 / 25 / 50 / 250 / 500mA / 5 / 10A
Res.:	Rx1, Rx10, Rx100, Rx1000 (1ohm to 16 Mohm)
db:	–20 / 0 / +62 (10 Ranges)
	160x120x60 mm
Weight:	530 gm
Socket:	4 mm

Price: **$25.00**

TV-7001

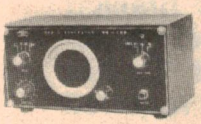


(FET VOM)

	12 Meg ohm input imp.
	Peak to Peak Values.
	Reverse Polarity Switch
	Int. battery check
DCV:	.5 / 1.5 / 5 / 15 / 50 / 150 / 500 / 1500V
ACV:	1.5 / 5 / 15 / 50 / 150 / 500 / 1500V
DCA:	.15 / .5 / 5 / 50 / 500uA – 5 / 50 / 500mA
Res.:	Rx1, Rx100, Rx1K, Rx1M (.2 ohms to 1000 Mohms)

Price: **$72.00**

MG-100

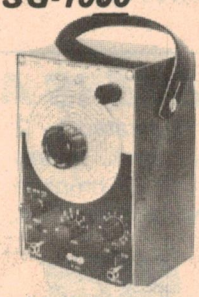


Audio Generator
Solid State, Transistorised
Excellent Frequency Response
Recessed Frequency Dial
Frequency Range:

Sine	19 Hz to 220 KHz 4 bands
Square	19 Hz to 100 KHz 4 bands
Accuracy:	±2%
Output:	10V P-P
Supply:	240V 50 Hz
Size:	180x90x90 mm
Weight:	1.2 kg

Price: **$56.00**

SG-1000



RF Signal Generator
Battery operated
Solid State, Transistorised
Frequency Range:

	100 KHz to 50 MHz on 6 fund. Bands
	50 MHz to 100 MHz on Harmonics
Accuracy:	± 0.05%
Output:	Variable oscillator, X'tal Osc. or calibration output
Modulator:	Internal or External
Suppy:	4 batteries UM-3
Size:	200 x 130 x 100mm
Weight:	1.4 kg

Price: **$56.00**

Plus 15% sales tax and $1.00 packing and post, if applicable. All units are supplied with batteries, leads and instructions. Leather Case available as extra.
These six units have been added to our large range of Electronic & Automotive test instruments.
All units may be inspected at our showroom and are available either direct from our Riverwood Office or any leading wholesalers. Alternatively units may be ordered on the enclosed coupon.

Please send to Mr.....
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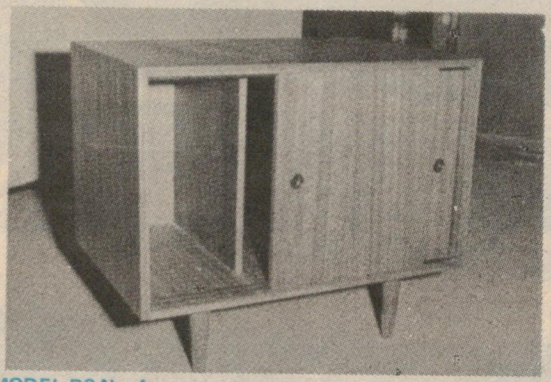
INSTROL RECORD STORAGE CABINETS

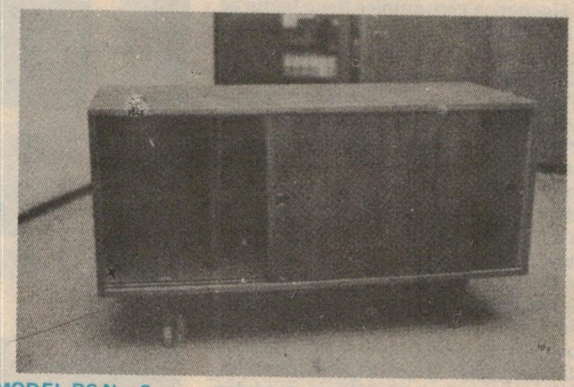
Now available in pre-cut kits

The Instrol range of record storage cabinets has the warmth and fashion appeal you expect of something which is to be part of your home. All veneered timbered panels are of the very best quality, both with the built and polished cabinets or with the pre-cut kits. Kits are absolutely complete in every detail, including detailed instructions.



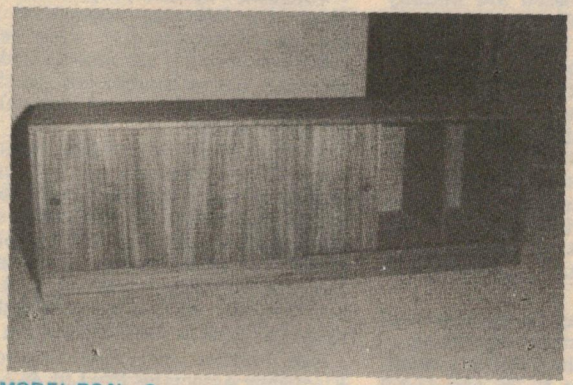
MODEL RS No. 1

A neat general purpose unit, designed to carry between 80 and 100 records, it measures 23¾" x 14" (high) x 14½" (deep). Kit price is $29.50 (teak or walnut veneer). Normally comes with base, but 4½" legs optional.



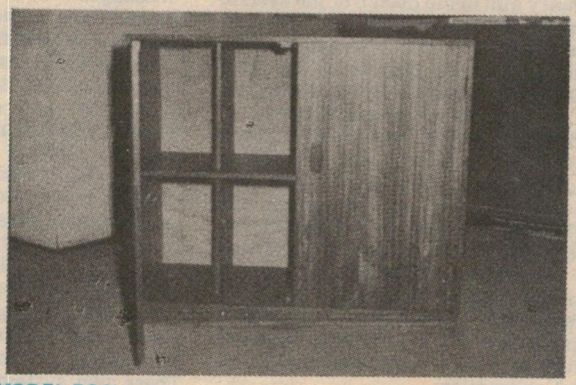
MODEL RS No. 2

A larger unit measuring 35½" x 14" (high) x 15¾" (deep), the kit is priced at $45.00 (teak or walnut veneer). Normally comes with base, but 4½" legs optional.



MODEL RS No. 3

This model measures 51¼" x 14" (high) x 15¾" (deep) and is priced at $49.50 (teak or walnut kits). Normally comes with base, but 4½" legs optional.



MODEL RS No. 4

This attractive model is aesthetically styled with full height opening doors and recessed handles cut from solid teak. With two record storage shelves, one on top of the other, and ample vertical dividers, the unit measures 35¾" x 31½" (high) x 16" (deep). Kit price is $65.00 (teak or walnut veneer).

INSTROL

HI-FI ELECTRONICS CENTRE

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375 LONSDALE ST MELBOURNE 3000. PH 67 5831

Please send me the following record cabinets. These will be sent by road transport or passenger rail, freight payable on receipt of goods.

. . . . . .at $ . . . . .

. . . . . .at $ . . . . .

. . . . . .at $ . . . . .

I enclose my money order/cheque for $ . . . . . .

NAME . . . . . .

ADDRESS . . . . . .

. . . . . P.C. . . . .

E312

NEWS HIGHLIGHTS

Telecommunications Instructional Module

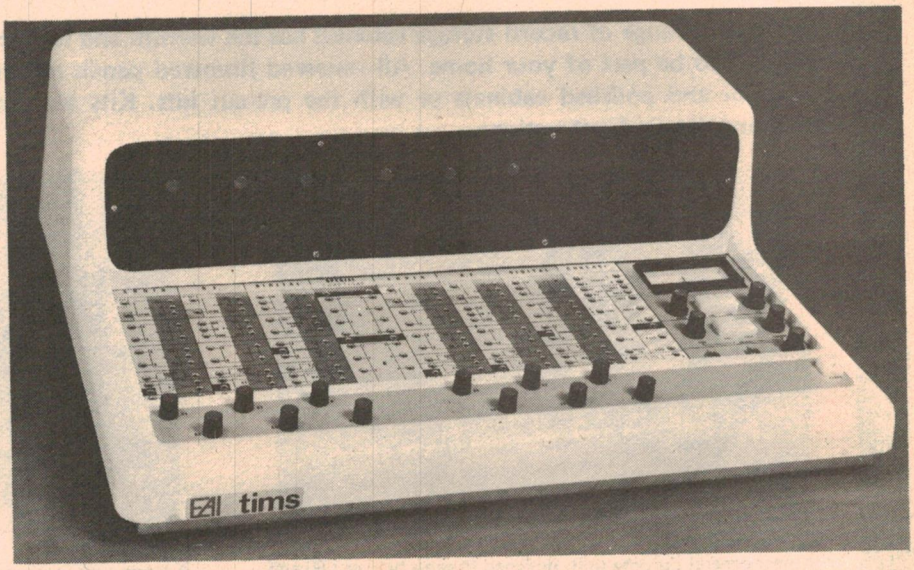
An Australian designed and produced communications instruction console has recently been made available to the Australian market. Designated TIMS (for Telecommunications Instructional Module System), the new system was designed by Mr Tim Hooper, a communications lecturer with the Department of Electrical Engineering at the University of NSW.

Developmental and pre-production work on the TIMS system was undertaken jointly by EAI-Electronic Associates Pty Ltd and Unisearch, the problem solving, research and development organisation associated with the University of NSW. The system is currently being manufactured by EAI at their St Leonards factory.

The new system is ideal for all technical training centres involved in the teaching of communications principles. It can model or simulate a wide variety of communications systems, thus enabling students to quickly grasp the underlying principles involved. The system consists basically of modular units, which are compatible in any configuration used to build up a communication system.

A primary aim in the design of the system was that it should provide for efficient, flexible and reliable operation. The manufacturers claim that even the most complex problems may be simulated in less than 10 minutes. To ensure a high degree of reliability, integrated circuits have been used wherever possible, and self-wiping high quality connectors have been employed. In addition, all programmable elements of the system are clearly labelled and colour coded so that outputs, inputs and control functions may be easily differentiated. Lighted pushbutton switches are employed for all switched controls, and all output stages have sufficient overload protection to prevent damage due to an incorrect connection.

It is possible to generate and receive a wide range of signals with the TIMS teaching bay, as well as to demonstrate many of the phenomena encountered in communications signals processing. The "messages" to be processed are initially derived from audio oscillator modules (to provide a deterministic, calculable signal). In addition, the system has a tape recorder input socket so that speech or music may be transmitted and analysed. Some of the systems which can be simulated by TIMS include: double sideband suppressed carrier, single sideband suppressed carrier, envelope modulation, frequency modulation multiplexing, phase division multiplexing, quadrature modulation, frequency modulation, time division multiplexing, and pulse code modulation.



The TIMS system may be purchased in either one of two standard configurations — the TIMS A system or the TIMS B system. These two systems cost $2,735 and $3,470 respectively. Items making up the TIMS A system are as follows: 1 basic console, 1 audio card, 1 RF card and 1 digital card. The TIMS B system consists of 1 basic console, 2 audio cards, 2 RF cards, 2 digital cards, and 1 special purpose card. In addition, the following accessories may be purchased separately: tape recorder, oscilloscope (BWD 539 recommended), XY recorder, stereo headphones, patching kit, trunk cable, maintenance manual, and a student manual.

To date, EAI have sold four of these units since it was released on the market in August. Of these, three have been sold to the James Cook University of North Queensland in Townsville and one has been sold to the University of Tasmania in Hobart. The Department of Civil Aviation, TAA, Qantas and the PMG, have also expressed a great deal of interest in the TIMS system.

For further inquiries contact EAI-Electronic Associates Pty Ltd, 48 Atchinson Street, St Leonards, NSW 2065. Telephone 439-7522. Also at 225 Park Street, South Melbourne, Victoria 3205.

Improved air-to-ground communications

The electrical and electronic research department at the University of Manchester Institute of Science and Technology (UMIST) is currently investigating interference effects that occur in digital data transmitted from an aircraft to ground via an HF radio voice channel occupying 3kHz in the three to 30MHz band. Statistical evidence has thus far shown that most of the interference occurs in two, or perhaps three, very narrow bands, each having an approximate width of 110 Hz.

This interference is accounted for by the fact that most operators in the HF band use frequency shift keying. Another possible source of interference is overlap from audio channels which could produce interference at the extreme ends of the 3kHz channel one is attempting to receive. It is evident that if these narrow band interference slots could be avoided, the air-to-ground bit error rate would be reduced.

One approach that is currently undergoing a great deal of research is to use a ground receiver which effectively chops the 3kHz band being received into bands 110Hz wide. This is achieved by using steep cut band-pass filters. The offending two or three 110Hz bands are then filtered out, so that although very little of the modulation is destroyed, the interference is removed, and the ground bit error rate is reduced. As yet, it is not clear how many 110Hz bands could be filtered out before data is lost, and further research will have to be conducted along these lines.

Another approach to the problem is to use a ground receiver to monitor the proposed 3kHz band whilst the aircraft is not transmitting. The aircraft is then advised as to which are the best FSK tones to use to avoid the current 110Hz ground interference slots. No problem is experienced in communicating with the aircraft as powerful transmitters and large aerial systems are used.

US-USSR space mission

A total of 18 scientific and space application experiments have been selected by NASA for the joint US-USSR space mission planned for 1975. Of these, four are in astronomy and space physics, five are in the life sciences, and eight are space application experiments. Several of these experiments are to be conducted in a small electric furnace similar to the one now flying in the Skylab space station.

The experiments were selected from among 145 proposals received by NASA in response to invitations issued to scientists in the United States and other countries. All results will be available to the world scientific community. Experiments which could include participation by the Soviets are contingent upon agreement with the Academy of Scientists of the USSR.

One experiment that is worth noting here is the spacecraft-to-spacecraft Doppler tracking experiment. The Apollo-Soyuz VHF ranging system will be used to measure relative changes in the distance and position of the two spacecraft. These changes indicate local anomalies in the Earth's gravitational field, thus providing valuable data on the internal distribution of the Earth's mass. This data contributes to geological and geophysical studies of continental drift, earthquakes, volcanic activity, and mineral resources.

The Apollo-Soyez Test Project (ASTP) will be the first international manned space flight. A primary aim of the flight is to test a docking and rendezvous system that will enable future co-operation in manned space missions. In addition, the development of a common docking system will contribute to the capability of space rescue missions. Target date for the launch is July 15, 1975.

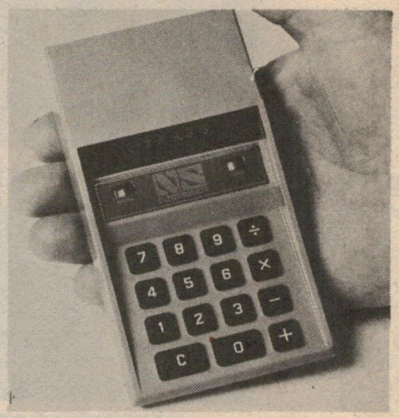
Lightweight gunfire control unit

Two international leaders in naval weapon control systems have collaborated to create one of the most cost-effective, lightweight gunfire control systems available today. The two companies, Marconi Radar Systems Limited and Sperry Gyroscope, are well established in this field and between them account for many of the advances in weapons achieved since World War II.

Designed for any size of warship from fast patrol boats upwards, the new system is capable of maintaining rapid and accurate control over small and medium calibre guns against air, surface or shore targets. In addition the system is fully-automatic, thus keeping manning requirements to a minimum. Only one man is required to operate the fire control system in an essentially supervisory role.

The new gunfire control system incorporates a Marconi Tracking Radar and a Sperry Predictor. The Marconi Radar Type ST802 has been selected from the Marconi 800 Series of radar weapon systems. It is an autonomous X-band tracking radar designed specifically to function in naval gun/missile systems. The Sperry Predictor is based on the Bracknell designed 1412 general-purpose computer which is currently entering service with the Royal Navy as part of the Exocet missile system.

Pocket calculator for less than $30



The latest shot in the pocket calculator price battle has been fired by NS Electronics, who have released the first calculator produced by their dynamic US affiliate, National Semiconductor.

Called the NS Model 600, the new unit is being marketed through department stores, pharmacy chains and discount houses. It offers a display of 6 digits, automatic integral exponents and automatic summing (also called "counting" on other calculators). But perhaps the most newsworthy feature is the cost: recommended retail is only $29.95.

Apparently this is even lower than the US retail price, thanks to bulk buying by NS Electronics, and a favourable rate of exchange.

Frigid record breaker

A miniature turbine-alternator, developed at the General Electric Research and Development Centre, Schenectady, New York, has set a new low temperature record for machines of its type. The device is a critical component of a supercold refrigerator designed to be used in such military and industrial applications as cooling superconducting motors and generators for ships and magnetically-levitated train propulsion, and for AC power generation.

In a three hour test, the turbine-alternator was cooled from room temperature down to 9.8 degrees Kelvin (-263.2 deg C) whilst operating at 100,000 rpm and producing 13.2 Watts of electricity. The unit provides the cooling necessary to reach cryogenic temperatures by removing energy from the refrigeration system in the form of electricity. During the test, the turbine-alternator was cooled and driven by helium gas vapourised from liquid helium.

To enable the unit to operate at extremely low temperatures, helium gas bearings have been employed. Gas bearings were selected because conventionally lubricated bearings would freeze solid at cryogenic temperatures. In addition, the use of gas bearings results in a virtually frictionless bearing that ensures long turbine life. A similar turbine, equipped with gas bearings, has been successfully operated at 100,000 rpm for 12,500 hours (about 17 months) without failure or maintenance.

"Donald duck" eliminators for US Navy

Marconi Space and Defence Systems Ltd has won a £23,000 contract to supply the United States Navy with a system that eliminates the "Donald Duck" effect normally evident in a diver's speech when he is breathing a mixture of oxygen and helium.

The "Donald Duck" effect is a result of the fact that a mixture of oxygen and helium, which divers use to breathe at depths greater than 600 feet, is less dense than air. This causes the diver's voice to rise in pitch, in some cases to an extent where it can become completely unintelligible to the listener.

The Marconi system, which is designated Type 023, was developed from Admiralty Research Laboratories (ARL) designs started in late 1968. It has already seen service in the Admiralty Experimental Diving Unit and the Royal Navy Physiological Laboratory, and was recently evaluated, with favourable results, in a series of medical research dives conducted by the Smithsonian Institute in the USA.

The system operates on a time stretching principle. The text of the diver's message is digitally recorded and about one third of this text is then reconstructed at a slower rate, whilst the rest is rejected. This has the effect of lowering the frequency of the received message to about one third of its transmitted value, thereby creating full intelligibility.

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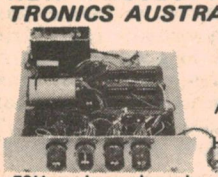

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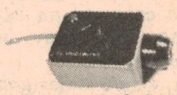

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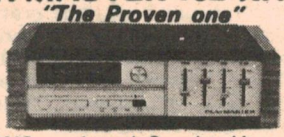

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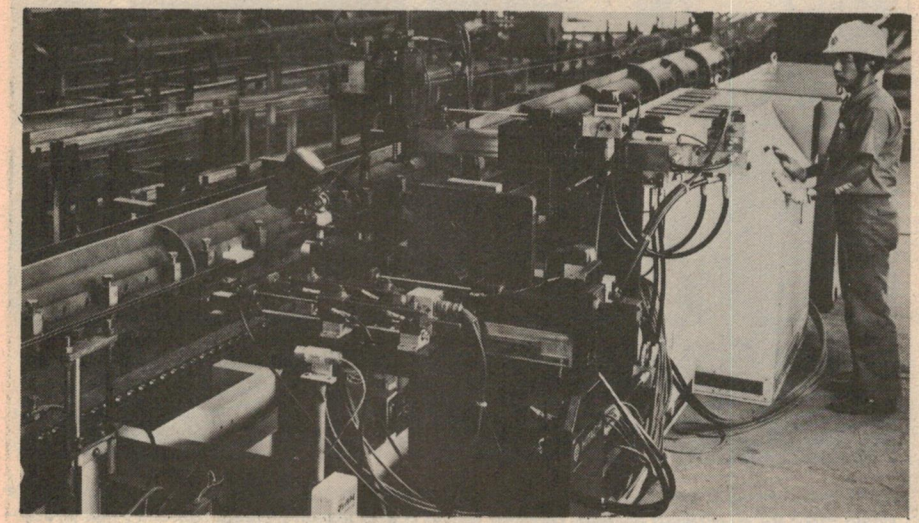
NEWS HIGHLIGHTS

Intelligent robot from Hitachi



Hitachi Ltd has succeeded in the practical application of an intelligent robot. Designed for industrial use, the intelligent robot employs pattern recognition technology and incorporates Hitachi's newly-developed "hand and eye" system.

Basically, the robot consists of a TV camera, a visual image processing device, tactile sensors, a servo type handling device, and control devices. Under operational conditions, the TV camera scans the object to be worked upon, and its shape and position are determined by the visual image processing device. This information is confirmed by the tactile sensors, enabling work orders to be sent to the servo control device.

The intelligent robot was first successfully employed in the manufacture of concrete piles and poles at the Kawashima Factory, Ibaraki Prefecture, of Nippon Concrete Industries Co Ltd, one of Japan's leading manufacturers in this field. Used for tightening the bolts on moulds for concrete poles, the robot has effected a marked improvement in efficiency.

Complete automation of the abovementioned operation proved to be an extremely difficult task. This was because there were many different kinds of moulds, the position of the bolts on the moulds varied, and, furthermore, there were other protruding objects such as steel ribs.

These problems were, however, overcome, and the robot performs its required operation quickly and efficiently. The TV camera scans the moulds as they pass by to determine the position of the bolts and other protuberances, and, after confirmation of the bolt positions by the tactile sensors, the servo handling device tightens the bolts with an impact wrench. At the same time, the servo handling device avoids any other protruding objects.

The time taken for the robot to pick out and tighten a bolt takes approximately 2.5 seconds. Besides its high efficiency and labour saving features, the robot offers an additional advantage in that all bolts are uniformly tightened. This results in an increased mould life.

Hitachi expects that its intelligent robot will find applications in other industrial fields, such as assembly and inspection processes.

Multi-purpose digital tape transport

A new British designed digital tape transport has recently been developed at SE Laboratories (EMI) Ltd, Middlesex, England. It is claimed that the new system is capable of complicated tape handling under non-computer room conditions, and that it is suitable for storing data in a multitude of applications, such as banks, factories, and supermarkets.

Designated the SE Series 8,000, the new system has a minimum of moving parts, is simple to operate, and is claimed to have high reliability and a long life. In addition, it is equipped with input and output connections that can be interfaced with the majority of tape formatters.

Another feature of the SE Series 8,000 is the servo unit which, due to its dynamic braking characteristics, prevents tape damage in the event of a power failure.

Women — space shuttle study

Clinical research into female physiology, aimed at developing selection criteria for women passengers in space shuttle missions, is currently in progress at NASA's Ames Research Centre, Mountain View, California. The studies are a follow-on from similar studies conducted last year on men.

Twelve volunteer nurses were recently used in the five-week experiment designed to determine the effects of weightlessness and low G forces on the female body. After two weeks of orientation and preliminary medical studies, eight of the twelve nurses simulated weightlessness by absolute bed-rest for a period of two weeks, whilst the other four acted as ambulatory control subjects. At the end of the two week period, the eight women were subjected to G forces of similar magnitude to those expected in a space shuttle re-entering the Earth's atmosphere at the end of a mission. A centrifuge was used for the G-tolerance testing.

The main objectives of the experiment were: to determine the tolerance of women to long periods of low magnitude G forces, to determine how well women can resist the tendency for blood to pool in the legs after a sustained period of simulated weightlessness, and to measure any specific physiological changes induced by the simulated weightlessness. Much of the data on the women will be compared to similar data obtained from male subjects to determine the reaction differences.

Principal investigator for the experiments is Dr Harold Sandler, Chief of the Biomedical Research Division at Ames. The project is under the overall direction of Dr Charles Berry, Director of Life Sciences at NASA Headquarters.

Award for Sydney scientists

Two Sydney scientists who designed an ozone monitoring device have been awarded the 1973 Sir Philip Baxter Award for air pollution control. The scientists, Mr Len Ferrari and Mr John Brown, who are attached to the NSW Health Commission's Air Pollution Control Branch at Lidcombe, began work on the instrument in 1971 when it first realised that Sydney had an ozone problem.

The new monitoring device operates on a chemical-luminescent principle. Ozone, which is present in the air, reacts with ethylene to produce light energy, the amount of energy released being proportional to the ozone content of the air. According to Mr Len Ferrari, this instrument is so sensitive that ozone quantities as low as 0.001 parts per million can be detected.

Ozone is produced by the reaction of nitrogen oxides and hydrocarbons which are emitted from car exhausts and industry. Levels in Sydney have reached 0.25 parts per million. This figure may be compared with normal background ozone readings of 0.01 to 0.02 parts per million.

The instrument is now being manufactured commercially by the Australian company Norian Instruments Ltd. To date, orders for the instrument have been received from six overseas countries.

NEWS

Talking ballpoint pen

A prototype model of a simple, inexpensive "talking" ballpoint pen that could reduce the amount of paperwork in routine business transactions has been developed at the Stanford Research Institute (SRI). The pen is similar in size and shape to an ordinary pen, except that it is wired to a computer system which is programmed to record information received from signals generated instantaneously as a person hand prints characters.

The laboratory prototype is a ballpoint pen containing a swivelled shaft on which is mounted a small light. Variations in the direction and angle of the pen give rise to signal variations in an optical sensor placed at the end of the pen, thus enabling the computer to determine the letter being printed.

"Such instantaneous and remote processing of data might be invaluable to large businesses engaged in daily consumer-oriented services, such as banks, insurance companies and utilities", says staff scientist Dr Hewitt D. Crane, the inventor of the pen. The pen could be used, for example, by a bank teller to credit a savings account. In this case, according to Dr Crane, the data would not have to be retranscribed by another employee, or put through expensive automatic reading equipment.

Another possible application is to use the pen in conjunction with a portable cassette recorder to record field data (for example, surveying or meter reading). The cassette tape may then be directly programmed into the central computer, thus eliminating the need to manually transcribe a day's worth of data.

SRI holds a patent on the pen and is currently seeking financial support for further development, Dr Crane says. He estimates that the pen will cost in the vicinity of $25 to $50.

TWA to equip 707's with STAN

Trans World Airlines (USA) is planning to equip its fleet of 18 Boeing 707-300C cargo jet aircraft with the Fairchild STAN (Summed Total and Nose-gear) integral weight and balance system. The order follows an intensive year-long evaluation of the system by TWA.

The Fairchild STAN system is an onboard system for determining an aircraft's gross take-off weight and centre of gravity. Devices are installed on the struts to measure the weight imposed on each of the landing wheels. A cockpit computer then processes this information to determine the weight and centre of gravity of the aircraft. The processed information is displayed on a digital read-out situated on the flight engineer's panel.

The new system provides an important safety check for both cargo and passenger aircraft and is currently being used in both applications by over 20 major domestic and international airlines. It can be installed on every major type of aircraft used in commercial airline applications.

Prince Philip Prize to Philips Industries

HRH Prince Philip presents Mr Duncan Glenn with the award certificate for the 1973 Prince Philip Prize for Australian Design. Duncan Glenn is the project manager of the Philips radioisotope on-stream analysis system which won the coveted award. At the centre of the photograph is Mr H. D. Huyer, Chairman of Philips Industries Holdings Ltd, who received a certificate on behalf of the company.

Computer produces telephone directories

A new computer system, developed by Bell Laboratories, has been designed to improve customer service, control costs and streamline record-keeping operations in the production of the Bell System's White Pages telephone directories. Designated DIR / ECT (for Directory Project), the new system is a more sophisticated version of its prototype, PHOTAC; a similar process developed by the New York Telephone Company.

The DIR / ECT system consists of a computer memory which stores directory information such as the customer's name, address, telephone number, and even the telephone book delivery instructions. The information in the computer memory is then fed into a device known as a photocomposer which provides ready-to-print listings.

In addition to the annual White Pages directories, DIR / ECT produces daily updates of new listings and monthly reprints of directories for use by the telephone companies' directory assistance operators. Another major advantage of DIR / ECT is the potential economy it will bring to the costly task of distributing the 170 million copies of Bell System White Pages directories every year. DIR / ECT automatically produces delivery instructions for the books, determines the weight of individual bundles, and counts the exact number of directories needed for each building in the delivery area.

Joan Nester, a computer systems specialist, holds a two-foot length of magnetic tape, all that is needed to store one page of information.

101.5 percent conductive

Australian copper has an electrical conductivity which is higher than 100 percent. Whilst theoretically this does not seem possible, the explanation of this apparent contradiction lies in the remarkable efforts made by the Australian copper industry to upgrade the purity of the products. Today, Australian copper exceeds the international standards of conductivity.

The International Annealed Copper Standard, IACS, for "high-conductivity" copper was recognised in 1913. It was then considered to be so high that up to little more than a decade ago many producers were taxed to hold the conductivity of their wire bars at what was then considered a safe excess over the specified minimum value. In recent years, however, Australia and the other world copper leaders have produced copper at the rate of millions of tons per annum at a purity of the order of 99.95 per cent. Such copper has an electrical conductivity of about 101.5 per cent IACS.

In fact, the standard in Australia is significantly ahead of international standards. Recent research has indicated that the practically attainable limit for copper is a conductivity close to 102.25 per cent IACS. On occasions, commercially available metal has risen as high as 101.8 per cent IACS.

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Cable TV: the long awaited dream—part 2

At present, most cable TV companies are losing money. However, one of the promising aspects of cable TV is that it offers a built-in medium for other money making ventures. In this, the second of four articles, the author examines the role of pay TV in the cable revolution.

by LES RICH

The concept of a "wired-up, plugged-in" nation, where every house in each state of the nation is linked in picture communication with a central source, is rapidly moving closer to reality. With the introduction of cable TV, this concept now calls for the introduction of public access TV channels and two way cable systems. In addition, the concept demands that the public have access to a large number of premium TV shows.

Attractive as these concepts may appear to be, somehow cable TV has to be economically viable. Putting this bluntly, in a free enterprise system it's not going to happen unless someone makes money out of it. And so far, profits in the major metropolitan markets have proved to be elusive. However, hopes have been high following a recent revival of the pay TV concept. New and improved versions of pay TV systems are at present being tried out in several cities, including San Diego, Wilkes-Barre, and Reston.

The point at issue is whether cable subscribers will pay an extra fee, over and above their monthly cable subscription of $5.00 to $7.00, to see an individual event such as a rock concert, a sports event, a Shakespearean production, etc. The reasoning is that only the big and well publicised attractions, such as mentioned above, will bring in extra subscribers at a price that will enable cable TV to expand in the cities.

In San Diego, the local cable company, Optical Systems Incorporated, reports that, on average, its salesmen get a new subscriber four out of every five times they make a demonstration. Subscribers are apparently impressed by the promise of pay TV in the form of concerts, plays, premium movies, and self-improvement courses such as lessons on speed reading and foreign languages.

The Optical Systems approach, which some think may point the way to the future, has also been called the "Chinese-menu" approach. First the viewer pays the basic charge. Then he can choose from several options, including a "season pass" for all pay events, a sports package, or a movie package; or he can choose individual shows.

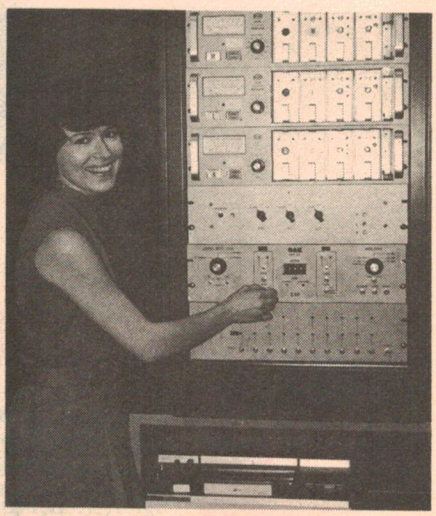
The method by which the viewer will activate his set to receive a pay TV show is, at the moment, very much in doubt. Warner Cable has a system known as "Gridtronics", which is currently being tried out in seven small cities. A special key is needed to unscramble the system to obtain the required show. Other systems are using computer cards to unscramble their respective systems. To keep people from using the card more than once, one proposal is for a "black box" that accepts the card, and then mutilates it.

"It is absolutely essential to have additional services beyond the improvement of normal TV signals," says Alfred M. Stern, president of Warner Communications. "Pay TV has to be the most important of these services in the near future."

It is no accident that all this may sound a little like do-it-yourself movies. Warner Cable is, of course, part of a parent company which also owns Warner Brothers. Gulf and Western Industries, owner of Paramount Pictures, is also involved in small cable holdings. Says James Leahy, executive vice-president of Viacom, another prominent cablecaster, "Pay TV will make us a newer and more efficient version of the movie theatre."

The popularity of special events has been proved in New York, where cablecasts of professional basketball and hockey are avidly watched from Park Avenue to Chelsea, so much so that commercials are now common. It is probable that, in addition to their subscription fees, subscribers would pay for these events. However, many would object strongly to the inclusion of commercials.

A new pay TV unscrambler system is also being promoted by Teleprompter. Developed jointly by Teleprompter and the



Shown at left is the Oak ESP (Expandable Scrambled Programming) home terminal for pay TV. Above is the Oak central control unit which controls the operation of program sources.

Magnavox Company, the new system permits cable TV subscribers to select and pay for films, sporting events, or other special interest programming on a per-program basis, without the need for phone calls, ticket purchases, plastic cards, or other devices. In addition, the Magnavox / Teleprompter system allows the cable subscriber to preview a premium program in his home. After a brief period of free viewing, the subscriber may purchase the program by simply pressing the "accept" button on a special home terminal.

The button instantly activates a control unit which simultaneously records the subscriber's purchase and unscrambles the signal so that the required program is displayed. Data read-out of home charges is periodically collected from the control unit (which is located outside the subscriber's home), and fed into a central computer for billing purposes.

The equipment problem for cable TV is a subject of much concern to Carl J. Bradshaw, president of the CATV Division of Oak Industries Incorporated. This company has just introduced a new system to allow the individual subscriber to select his required pay TV program. The system provides for a converter capable of handling up to 31 channels, a considerable improvement over the 12-channel converters now in use in most cable systems.

"This is what seems to be called for now," says Bradshaw. "We think the next step will be two-way programming, offering a whole host of services in which the consumer can talk back to the TV set. But I think it may take a decade or more before this becomes common. Two-way systems will require many changes in cable systems that already exist. The hardware in the home will have to be expanded somewhat. But the concept of the plugged-in nation will be a reality. And I think it will bring about economic and social changes greater than the advent of TV itself."

Meanwhile, Bradshaw's division is concentrating on a more pressing problem — financing new cable TV systems. The industry is still quite fragmented, and, at the present time, there are a number of small firms attempting to raise sufficient funds to wire their markets.

"When they go to some sources, they're hit with a demand for equity," says Bradshaw. "We don't do that. We simply make a business out of making loans to cable companies. We have loans out to many small companies for, say, a couple of hundred thousand dollars, and we've also lent money to Teleprompter to the order of $10 million. With up to $100,000,000 a year to be spent on equipment in the next seven or eight years, we think that the cable TV loan business is a good spot to be in. However, we're still more interested in the hardware."

As the concept of pay TV moves closer to reality, the development of new unscrambler systems promises to intensify. Just a few months ago still another "home box office system" was patented by Theatrevision Incorporated, a company whose president is Dore Schary, a former movie producer. The system is already being tried out in Sarasota, Florida, where three movies a night are available in 750 homes and 250 motel rooms. The subscriber buys a ticket and puts it into a ticket taker which is about the size of a portable radio. And earlier this year, Time Incorporated made an agreement with Hilton for pay TV in hotel rooms. This agreement called for the installation of new colour TV sets at a cost of $3.5 million.

Cablecasters are, therefore, depending on pay TV to make their operations profitable. By comparison, the older method of support by advertisers seems to be much more doubtful. Even if 40 per cent of the nation's TV sets are wired for cable TV, the advertiser would still have access to less than half of the sets in a given area. From the advertisers point of view, these conditions are quite unattractive.

During a unique CATV cablecasting venture, Bob Burke, cablecasting director for Warner Cable, Pittsfield, interviews TV dealer Betty Roan. Filmed in the store, the two hour program featured displays of television receivers and stereo equipment, and invited CATV subscribers to phone in their orders. The cablecast resulted in the sale of 52 major units.

At left, Warner Cable's Pittsfield technical director Peter Suluk stars in a "dial-a-Santa" cablecast show. Eavesdropping on the call from a young viewer is program director Bob Burke. Above is an Esperanto lesson being cablecast from one of Warner Cable's Pittsfield studios.

Electronics in tomorrow's cars

After a slow beginning, electronic technology is beginning to permeate the automobile industry. In this article, the first of a two part series, the author examines three new automotive electronic developments which are likely to be incorporated into vehicles in the very near future.

by COLIN MAITLAND

Electronics and its associated technologies seem to have permeated almost every field of human society. Communications, health, industry and even governments, seem to be dependent on electronic assistance.

However, the automobile industry seems, at first sight, to be lagging behind this general trend. The average car, or lorry, displays little electronic gadgetry. Its vital guidance, braking, and lighting systems are still comparatively primitive in design and function. Whilst it is true that some cars now feature an electronic ignition system, these are still very much a minority.

A look "behind the scenes" at electronic research and development reveals a very different picture. Spurred on by public demand for increased vehicle performance, and governmental demand for improved safety standards, manufacturers and researchers are combining to make rapid strides in the application of electronics to road transport. There will almost certainly be major developments in automotive design in the near future, and electronics will be a key factor in this development.

The idea of an electronic (or transistorised) auto ignition system is by no means a new one. It has been more than fifteen years since automotive engineers in the United States first recognised that the archaic electro/mechanical ignition system, whereby tungsten contacts were called upon to handle extremely high currents, had reached the limit of its development. The answer to a better system lay in finding a device that would remove the high current load from the points, and handle the load itself, without self destruction.

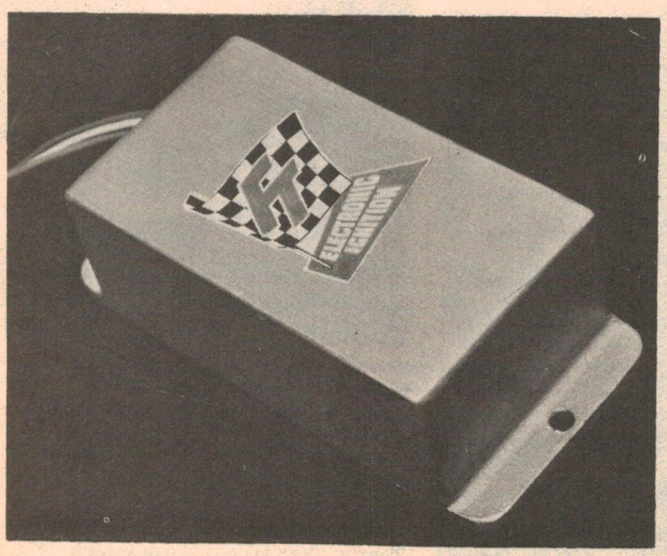
From the beginning, the development of electronic ignition systems has tended to follow diverse paths. Some manufacturers (chiefly American) concentrated on eliminating the contact points altogether, replacing them with a variety of systems ranging from Motorola's, which supplied magnetic trigger impulses to an amplifier-driven circuit, to Motion Incorporated's which used a cold-cathode gas diode in conjunction with a cold-cathode thyratron.

The cheaper, mass-produced systems opted for the retention of the contact points, relegating them to a switching function where they no longer carried high currents. Two types of electronic ignition systems have become dominant in recent years: transistor assisted ignition, and capacitor discharge ignition. Whilst the latter is preferred, it is also more complicated, and it was long felt that cost would rule it out for mass production. However, improved production techniques and cheaper component costs have enabled capacitor discharge systems to compete favourably with conventional ignition systems.

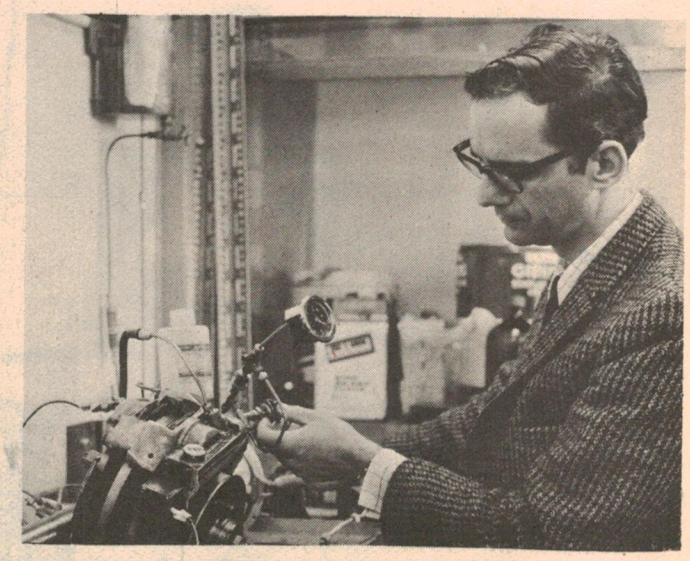
Indeed, one British company, Future Tecmatics, is now offering a capacitor discharge ignition system for less than £12. The system is suitable for most family cars, and requires no special modifications to the ignition coil, or associated components. Offering increased fuel economy, longer spark plug life, better engine performance, and lower exhaust emissions, electronic ignition is undoubtedly a major advance in automotive technology. By 1980, most (if not all) cars will be fitted with such systems as standard equipment, and the complex electro/mechanical system, which has held sway for over 60 years, will finally be declared obsolete.

It is widely accepted amongst drivers, research engineers, and safety officers that one of the major causes of automobile accidents is wheel lock, and subsequent loss of control of the vehicle, caused by "panic braking." Safety organisations advocate "cadence braking" in acute situations; that is, a constant jabbing of the brake pedal instead of a continuous application of pressure. However, few drivers stay calm enough to carry out this procedure in an emergency.

The answer to this problem lies in the development of an automatic braking system designed to release brake pressure when wheel lock appears imminent.



The electronic ignition module currently being marketed by Future Techmatics.



An engineer measures the characteristics of Mullard's electronically controlled anti-lock braking system.

However, the cumbersome size and high cost of early designs frustrated attempts to produce these systems commercially, although Dunlop have, for some years, marketed their "Maxaret" system on four wheel drive Jensen cars. In 1970 Mullard Ltd announced a new anti-lock system claimed to be the first ever economically acceptable system for use in all types of motor vehicles.

As with most new automotive control systems, the Mullard system is a fusion of electronic and mechanical components. Diagnosing the condition of a road wheel is best done by electronic means whilst releasing and re-applying the brake is clearly a mechanical function.

Mullard originally researched the electronic problem with a view to adapting one of the existing anti-lock mechanisms. However, it was soon decided that none of the current systems offered sufficient potential for long term development. As a result, Mullard developed a new type of brake pressure modulating mechanism to be used as a test bed for electronic sensing circuits.

Basically, the system consists of a control circuit which monitors the wheel speed by means of a toothed ring mounted on the wheel hub. A magnetic pick-up, positioned near the ring, supplies a train of pulses to the control circuit. The pulse frequency is proportionate to the wheel speed and thus contains all the information necessary for the circuit to deduce the acceleration, or deceleration, of the wheel.

Unfortunately, the pulse train from the magnetic pick-up contains a considerable amount of noise due to vibrations within the wheel. Instead of designing a more complex pick-up unit, Mullard designed a noise rejection circuit which emphasises the required signal and eliminates most of the noise. As quantity production versions are to be made in integrated circuit or thick film form, this circuit should have little effect on the overall cost of the unit.

Whilst the control circuits can determine the onset of a dangerous wheel condition, they cannot modulate the brake pressure. A mechanical actuator was needed and Mullard decided to tackle this problem in a novel way. Realising that previous systems had floundered on the size / cost factors inherent in the use of electric motors, large solenoids, or vacuum servo units, it was decided to take energy from the wheel itself.

When the electronic control circuit senses an impending wheel lock condition, it energises a hydraulic solenoid valve which relieves the brake pressure and, at the same time, applies a piston to an eccentric wheel hub. This piston then pumps the brake fluid, diverted to it by the solenoid valve, back into the brake line. If, however, the wheel approaches a lock condition, the pumping action of the piston ceases until sufficient brake pressure is relieved by the solenoid valve to enable the wheel to rotate. Each wheel is controlled independently, thus ensuring the shortest possible stopping distance and maximum steering ability during emergency braking procedures.

The result of Mullard's development work is a compact system in which the brake, anti-lock mechanism, and electronic sensing circuit form a single unit which is mounted on the road wheel. Several motor manufacturers are now studying the Mullard anti-lock system, together with other anti-lock designs. Although it is felt that there may be customer resistance to

THE CARTRIDGE KILLER.

Scott Muni
WNEW-FM, New York

This man doesn't have time to baby the tools of his trade. Not with a commercial, a traffic report and time check breathing down his neck. He's got to keep those records spinning fast and furious. And, if he kills a cartridge or two along the way, well—that's how it goes.

Until now.

Meet the Stanton 500AL—the cartridge that's tougher than disc jockeys. Here is the workhorse of the broadcast industry. We designed the entire stylus assembly to withstand the rugged demands of back cueing and the kind of handling that would quickly ruin ordinary pick-ups. Yet its high restoring force and tracking reliability is accomplished without sacrifice of professional standards for frequency response, output, channel separation, etc.

The Stanton Model 500AL is just one of many cartridges engineered by Stanton for the varied and critical applications in the fields of broadcasting and recording. For nothing less than Stanton performance and reliability would meet the needs of the engineers who have made Stanton —The Professional Standard.

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VIC.: BJD Electronics P/L., 191 Bourke St., Melbourne 3000.
QLD.: Brisbane Agencies, 72 Wickham St., Fortitude Valley.
N.S.W.: Linear Sound P/L., 639 Pacific Hwy., Chatswood, 2067.
S.A.: Sound Spectrum, 33 Regents Arcade, Adelaide, 5000.
A.C.T.: Pacific Stereo P/L., 17 Style Arcade, Manuka, 2603.

the added cost of a safety accessory, it can only be a matter of time before electronically controlled anti-lock brakes are the rule rather than the exception.

Another safety application for automotive electronics is in electronic seat belt circuits. Although it has been shown that seat belts can significantly reduce the risk of accident injuries, they have provoked staunch resistance from the motoring public, despite legislation which makes the fitting of seat belts to cars compulsory.

Legislation to enforce the wearing of seat belts is now in force in parts of the United States, France, and Australia. However, successive governments in Britain, and elsewhere in Europe, have been hesitant in adopting legislation along these lines. The alternative seems to be "compulsion without the law" — that is, a seat belt that either immobilises the vehicle until the belt is fitted, or one that is deployed automatically.

It is probable that the latter system will ultimately prevail. In the meantime, however, active development of "foolproof" electronic seat belt systems is continuing. In Britain, both British Leyland and Ford, who are working with Mullard, have made significant progress in this field.

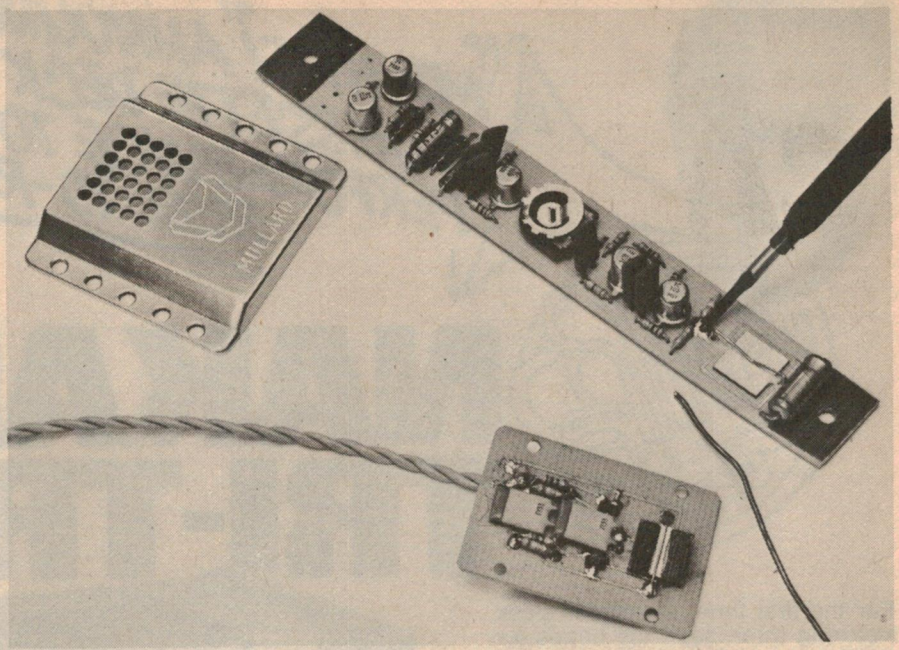
British Leyland's system uses two sensing switches operating in conjunction with a logic circuit. One of the switches is mounted in the seat cushion (to detect to presence of the occupant), whilst the other is situated in the belt buckle. The two sensors are linked to the logic circuit, which records the order in which the switches were activated.

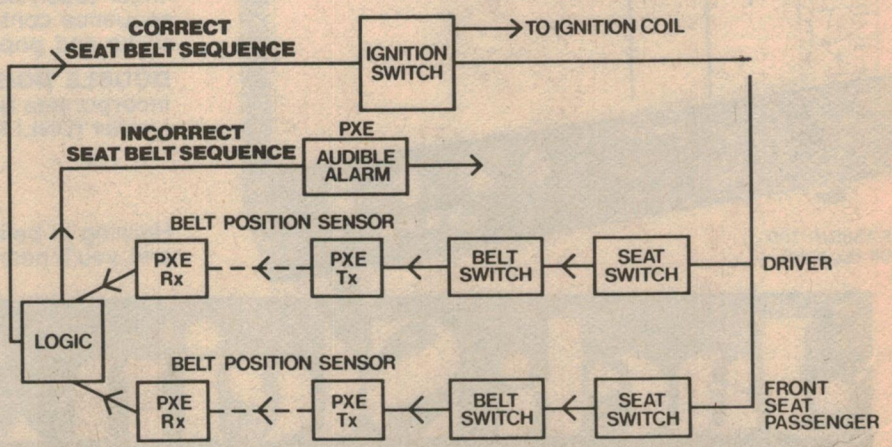
If the occupant fails to activate one of the sensing switches, or if the switching sequence is wrong, the engine's starter is automatically disconnected. Certain safeguards are, of course, incorporated in the system. Once the engine is started, the seat sensor is de-activated so that the occupant may adjust his seating position. In addition, the engine starter is operable, without interference from the circuit, for a period of three minutes after the engine has been turned off.

The Ford / Mullard system takes anti-cheat precautions one step further by using ultrasonics to ensure that the seat belt is not only worn, but is worn in the correct position. In addition to seat and buckle sensors, this system consists of an ultrasonic transmitter which is mounted in the seat belt, and a detector which is mounted in the windscreen pillar. The ignition sequence is completed by fitting the seat belt and adjusting it to its correct position so that the signal from the transmitter is directed towards the detector. If the sequence is not completed, the driver is warned by an alarm (both audible and visible) mounted on the dashboard. Should the belt be disconnected whilst the vehicle is moving, the engine will operate for a pre-determined safety period.

It has been estimated that ignition-wired seat belts would achieve an effective usage rate of 95 per cent, and add approximately £25 to the cost of a new vehicle. However, many critics claim that the systems are too complicated and that they are prone to tampering.

Thus far, we have had a brief look at three new electronic developments in the automotive field, all of which are likely to become commonplace in the near future. Next month, we will examine some of the more radical motoring innovations that are planned for future vehicles.





Shown at the top of the page are the receiver and transmitter modules of the Ford / Mullard ultrasonic seat belt system. A transmitter unit fitted to a seat belt is shown at centre, whilst directly above is a block diagram of the Ford / Mullard seat belt circuitry.

"MR HI-FI" ANNOUNCES— A CASSETTE DECK EQUAL IN PERFORMANCE TO THE FINEST REEL-TO-REELS!

NAKAMICHI TRI-TRACER

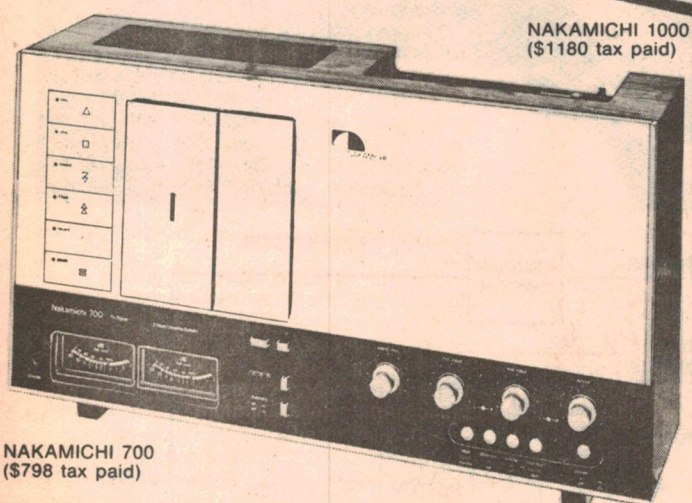
For the first time, a cassette deck featuring three separate heads for instantaneous tape monitoring, and an inbuilt alignment system to eliminate the distortion you've experienced in conventional decks.

THREE HEAD CONFIGURATION
Separate record, playback and erase heads with minimum gaps ensure a frequency response of up to 20 kHz — by far the widest bandwidth ever obtained with a cassette system and at least equal to the best reel-to-reels.

INBUILT AZIMUTH ALIGNMENT SYSTEM
Enables individual head adjustment for perfect alignment.

THREE HEADS MAKE IT POSSIBLE

NAKAMICHI 1000
($1180 tax paid)



NAKAMICHI 700
($798 tax paid)

IC LOGIC ELECTRONIC CONTROL
All tape motion controls are solenoid operated with light finger touch buttons. IC Control Logic circuit produces a sequence control of complicated timing which eliminates clicks and pops.

DOUBLE NOISE REDUCTION SYSTEM
Incorporates both Dolby N R System and Dynamic Noise Limiter (DNL) to suppress noise level by more than 13 dB.

Hearing is believing . . .
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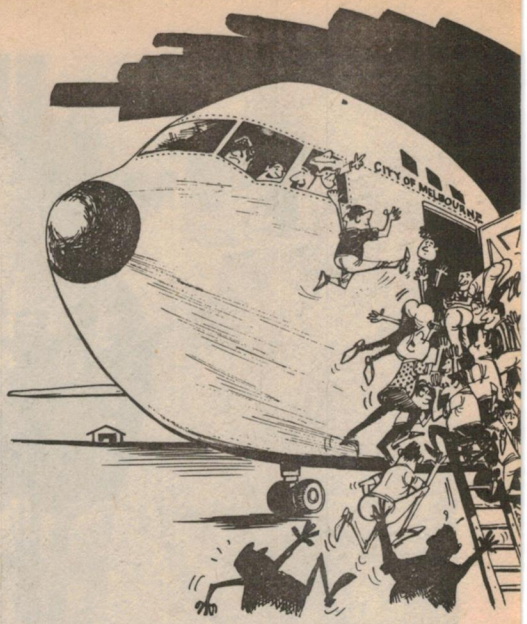
275 Clarence Street (Town Hall end) Sydney 2000. Phone: 29-6315

JS 017/FP

THE "GREAT PLANE CAPER"



What can a company do to get its message across to hifi dealers throughout Australia? It could buy time on television, or space in the media. Or it could do what Goldring did recently: take the dealers and the press for an all day trip in a Jumbo jet, wine them and dine them, and say its piece when they were in a highly receptive mood!

by NEVILLE WILLIAMS

"The Great Plane Caper" cost Goldring Engineering A'Asia Pty Ltd quite a packet — best part of $40,000 in fact — but they could be sure of one thing: not one of the 353 guests who flew to New Zealand and back were the slightest bit vague about the identity of their hosts or the purpose of the trip. It was intended to underscore three names: Goldring, Aiwa and Certron. In charge of the whole operation was National Advertising and Sales Promotion Manager, Ian Woodhouse.

No one aboard the plane had any reason to dispute Goldring's claim that "The Caper" was a first in the history of the Australian hifi industry — at least on anything like a comparable scale.

I can remember a flight in a Dragon Rapide biplane, which belped publicise PA equipment, but that was over Sydney beaches with just three of us aboard!

The Caper was also a first for Qantas. Over the years, the airline has chartered many planes for many purposes, but this was the first time it had chartered a Boeing 747 to a private company for a full-scale international publicity venture. And it was certainly the real thing, with airline bag, kit and trinkets for all passengers, full cabin service and two Qantas quality meals complete with champagne.

No wonder the trip sparkled with goodwill, particularly on the return flight.

In actual fact, the name Goldring has been around the Australian hifi scene for a long time, dating back at least to the immediate post-war period. It so happened that, when the two founders of the Australian operation arrived in Sydney, they came looking for the Editor of the one technical publication they had been able to find — then known as "Radio & Hobbies."

At the time, the record industry around the world was in a state of turmoil. Manufacturers were under heavy pressure to reduce surface noise and distortion, widen frequency response, and increase playing time.

Some companies favoured completely new "microgroove" standards; others wanted to fine down the grooves of conventional records, hoping to get acceptable results without completely throwing overboard the traditional 78rmp format. The result was a confusion of groove dimensions and more distortion than ever if stylus and groove did not match!

Goldring's answer to this frustrating situation was their "Headmaster" pickup, which came complete with a selection of interchangeable heads and an adjustable top-cut filter. Hopefully there would be a head and stylus to suit every record in every collection, from the old American wide-groove 78's to the then-latest ffrr Deccas.

By modern standards, it wasn't much of a pickup but it did draw attention to groove dimensions, sapphire styli, tip radius, and removable rather than integral heads.

There were other companion products but, after this early innovative period, Goldring settled down to supplying the mass market with piezo cartridges, replacement styli and a variety of other audio gadgetry which certainly sells but which doesn't make headlines.

In fact, marketwise, Goldring slipped into the doldrums. If this sounds uncharitable, it is precisely what Goldring executives told their guests on the Great Plane Caper. The whole point of the exercise was to get Goldring off the ground again — literally!

The company would still be pushing all their traditional lines under the Goldring brand, using a new re-styled logo. But they would also be putting more push behind AIWA products in Australia, and a new brand of high-performance magnetic tape: CERTRON.

It was about this stage in the in-flight presentation that someone near me suggested that this would be an appropriate setting for a hijack. The plane was scheduled to land at Christchurch, only the second 747 ever to do so. Thousands of sightseers were expected at the airport and nature had provided a balmy spring day for the occasion. "Qantas" and "Goldring" would be everywhere.

What a temptation for a rival concern to poke a gun into the pilot's ribs and make him fly some place else!

It was also about this time that I noticed something wrong with the geography. We were still at 35,000ft and although there was land below, ocean was visible on the right hand side. Either something very dreadful had happened to the shaky isles or we were giving Christchurch a miss!

There was no chance of checking the flight deck for a hijacker because passengers were relaxing in the upstairs lounge, shoulder to shoulder, about 35 deep, and all talking at once to no one in particular!

In that cacophony a conspirator could have had a cannon cocked in the cockpit!

About 10 minutes later, the Captain's voice came through on the PA. In carefully measured tones he explained that a minor technical fault had been noted in the anti-skid braking system and that the plane was being diverted to Auckland.

No mention was made of any hijacker and, of course, there was no panic — just dismay.

You have to hand it to the Qantas / Goldring team. None of the guests even caught a glimpse of the hijacker at Auckland and, by the time we had negotiated the tiny mens' room at the airport, and the customs, they had organised a fleet of buses for a tour of the city. This, in the middle of a long labor day weekend, with just about everybody away in Christchurch, waiting for the Jumbo down there!

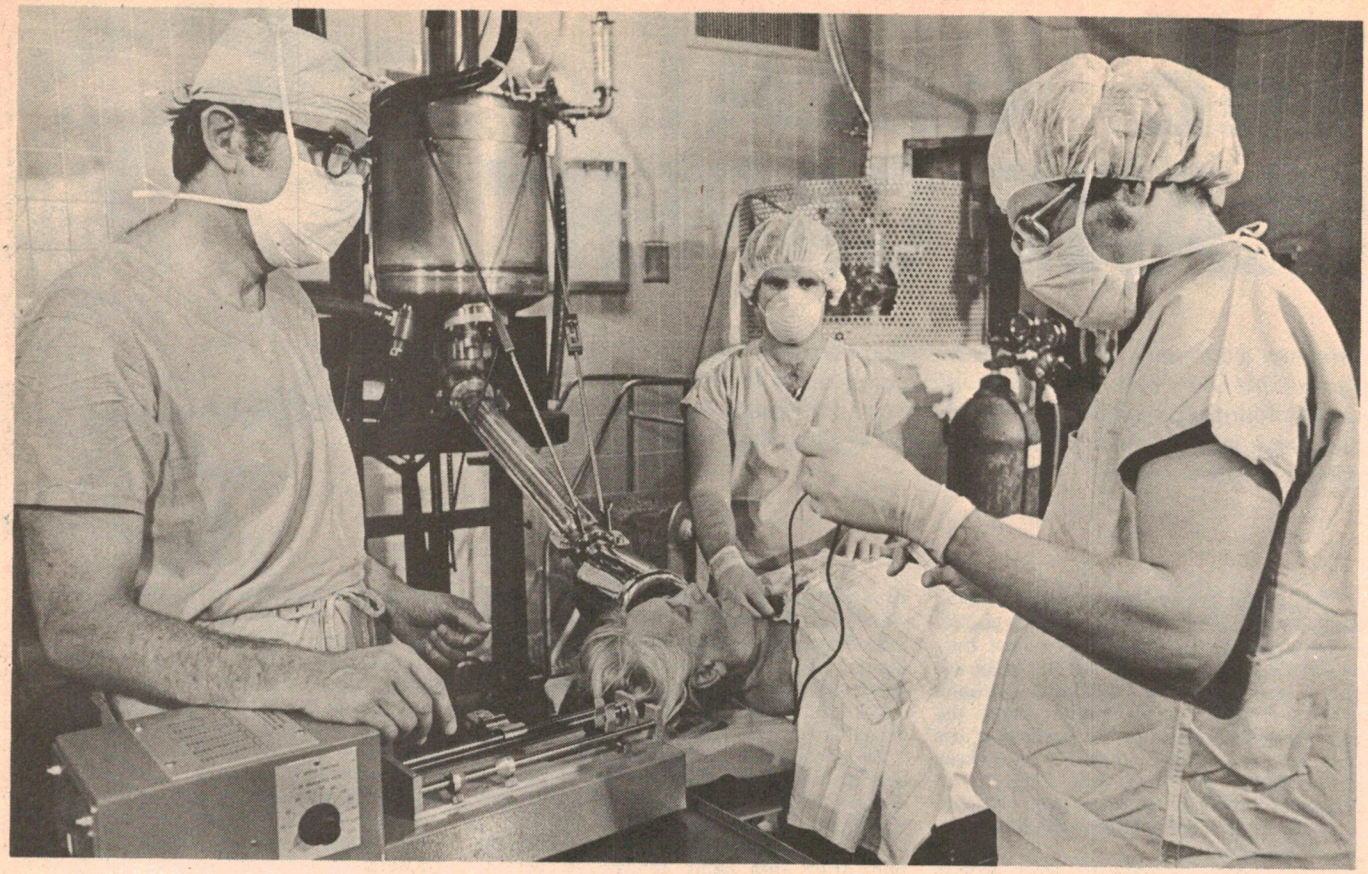
How they got the buses through to Auckland in that time, we will never know!

Not only that, but they found two people to operate the duty-free store. Decades hence, these two people will be telling their grandchildren what it was like to be faced with 353 Orstralians — all waving new $50 notes and all pointing to the Scotch!

But other than that it looked like a pretty successful bit of publicity as the plane headed back into Sydney, and the Opera House and the fireworks.

As one of the cabin crew put it: "I know some of you are still flying high, but the plane is down to 9½ thousand feet and you simply must sit down and fasten your safety belts!"

To which one answer was: "Letsh 'ear it fer Qantash . . . an Golring . . . and Ian Woo'ouse!"



New advances in cancer detection and treatment

Cancer research programs in the United States have unveiled two new electromagnetic techniques developed separately by scientists at the National Bureau of Standards and at the University of California, Los Angeles. Coupled together, the two new techniques represent significant progress in the detection and treatment of cancer.

by GREG SWAIN

Experiments conducted by scientists at the National Bureau of Standards, US Department of Commerce, in Gaithersburg, have successfully detected differences between normal tissue and malignant tumor growth in live mice by a process known as nuclear magnetic resonance (NMR). NMR requires neither anesthesia nor surgery and it provides immediate results.

The studies were performed by NBS materials scientists Dr Irwin D. Weisman and Dr Lawrence H. Bennet in co-operation with Dr Louis R. Maxwell Sr, a physicist retired from the U.S. Naval Ordnance Laboratory, and Drs Mark W. Woods and Dean Burk of the National Cancer Institute.

Although the first experiments using NMR for cancer detection were performed on mice, scientists feel that further development of the technique may provide a safe, painless tool for the detection and monitoring of tumor growth in humans.

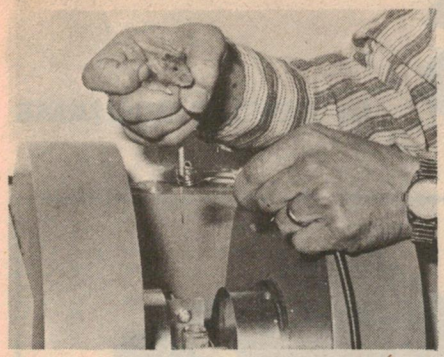
NMR was first discovered in 1945 by E. M. Purcell and F. Bloch, who later shared the Nobel Prize for their work. Materials are studied by utilising the interaction of the magnetic moment of their atomic nucleus with an externally applied magnetic field.

Nuclear magnetic moments behave like weak bar magnets. When a material is placed in a uniform, external magnetic field, the nuclear magnetic moments of the atoms align themselves parallel to the external field. The moments can be rotated away from the field direction by applying radio-frequency (RF) energy at the resonance frequency. When the RF energy source is removed, the nuclei return to their positions parallel to the magnetic field in a characteristic, measurable time known as the spin-lattice relaxation time (T). The duration of T is influenced by the surroundings of the atom and the motion of other atoms. Changes in T reflect changes in atomic surroundings.

In the NBS studies, measurements on protons in the tissue water of a mouse's tail were made using a conventional pulsed NMR spectrometer. The tail was placed in a wire coil which formed the spectrometer probe, and the probe was placed between the pole faces of a laboratory DC electromagnet.

Measurements taken over a period of time revealed the growth of the tumor, a transplanted malignant melanoma. A change from normal to malignant tissue was evident in the relative change of NMR signals associated with the tumor compared to normal tissue relaxation times. The tumors displayed proton spin-lattice relaxation times of about 0.7 second, in contrast to the simultaneously measured normal tissue proton relaxation times of about 0.3 second.

By using magnets with a larger sample space, experiments could be performed on larger animals and on humans. Probe coils



At left, a woman patient undergoing treatment for cancer at the University of California at Los Angeles. Above, a scientist conducts nuclear magnetic resonance measurements on a mouse's tail.

of varying sizes and shapes would have to be designed to fit various parts of the body. If this technique can be developed and applied at a practical level, competent technicians would be able to test a patient in a matter of minutes.

Significant progress in cancer research has also been made at the University of California at Los Angeles, (UCLA), where a new electromagnetic technique for removing selected cancer tissue and repairing damaged blood vessels has been developed.

The practical, low risk procedure, which utilises a powerful superconducting magnet and a silicone-iron compound, was devised by Drs Robert W. Rand and James A. Mosso.

A liquid silicone compound containing iron particles is delivered to the blood vessels supplying the tumour via a tiny, flexible tube (catheter), threaded through other vessels to the target site. The superconducting magnet holds the compound in place in these particular vessels so that none escapes into the general circulation. A catalyst is then added, causing the liquid compound to harden and form a solid core in the vessels, thus sealing off the tumour's blood supply. Denied its blood supply, the tumour dries up and eventually disappears.

Using this procedure, doctors at UCLA have successfully treated a 39 year old woman with an inoperable tumour of the adrenal gland, and a 70 year old woman with a brain tumour. Two patients with aneurysms were also successfully treated with the new technique.

The idea is an offshoot of the technique used to cure aneurysms, which are weakened, ballooning sections of blood vessels. The original technique called for the placement of ordinary bar magnets close to the aneurysm. This procedure usually necessitated high-risk surgery. In addition, there was the danger that little beads (emboli) of the silicone-iron compound might escape into the general circulation and lodge in the lungs.

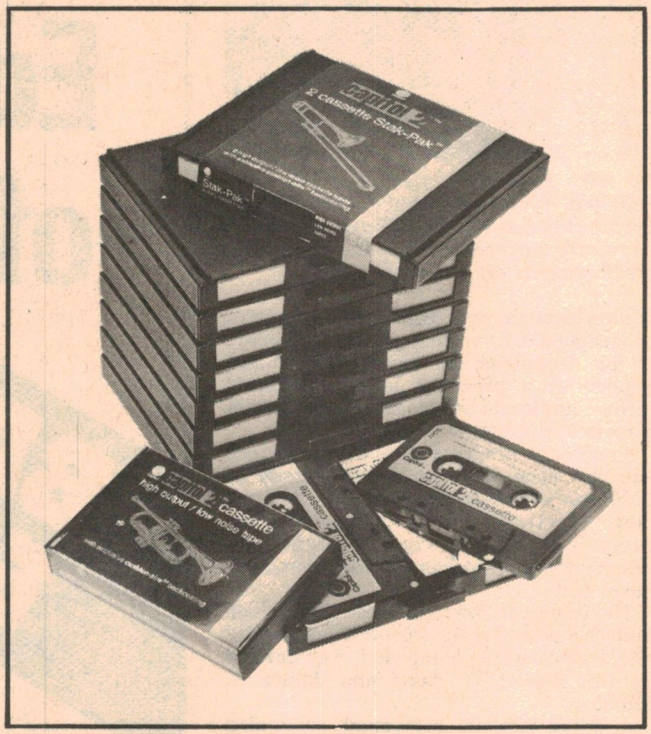
By utilising a superconducting magnet, these latter two problems have been solved. The superconducting magnet, which is cooled by liquid helium, was designed and constructed at the Cryogenics Laboratory of the Stanford Linear Accelerator Center.

Dr Rand believes that the new procedure should be effective in treating most discrete tumour masses within the body. The technique could also be used to selectively destroy part or all of a diseased organ, such as a spleen or kidney.

HIFI NEWS

by NEVILLE WILLIAMS

The audio industry which, not so long ago, produced chromium dioxide recording tape, is now apparently doing its level best to make it unnecessary. Certainly, the current emphasis is very much on ferric oxide tape, with several manufacturers vying for market leadership.



EMI's new Capitol cassettes are available singly or in their new "Stakpak" storage chest. This is made up of as many drawers as the user desires, locked together into a single, neat "chest of drawers". For their Capitol cassettes, EMI are claiming both improved electrical performance and greater reliability.

Reduced to basics, ferric oxide tape is virtually the same as it has always been: A layer of ferric oxide particles, suspended in a binder and applied to one surface of a plastic tape.

In detail, however, a great deal has happened since the first tapes appeared on the market.

The base film or tape has been made stronger, more flexible, less likely to wrinkle or warp, more tolerant of ambient temperature and so on — characteristics which make for more consistent and reliable operation in the mechanical sense.

Attention has also been paid to the binder which has to contain the ferric particles and, at the same time, bond reliably to the base film; this in spite of the bending, stretching and abrasion which it undergoes in service. If the binder cracks or flakes, even minutely, or lets go of particle lumps, the tape begins to suffer from signal "drop-outs." Again, this is largely a "mechanical" quality.

It is in the area of oxide formulation where so much has been done to achieve improved electrical performance.

The objectives have been clear enough from the start: an oxide formulation with appropriate magnetic characteristics, small and uniform particle size, uniform layer thickness, non-abrasive surface and so on. The production technology to achieve these objectives has been limited, however.

In the early days of tape recording, limitations of head design and tape characteristics combined to set a rule-of-thumb ceiling on the upper frequency response of a tape system, being about equal in kilohertz to the tape speed in inches per second. Thus, a system travelling at 7½ips would be doing as well as could be expected if it produced an effective response to 7.5kHz.

On this basis, the slower speeds were obviously limited to low fidelity applications.

Gradually, however, heads and tapes alike were improved and the relationship gradually stretched from 1:1 to 1½:1 and then 2:1. 7½ips became a high fidelity speed and 3¾ips a speed capable of good quality reproduction. But 1-7 / 8ips remained a poor man's speed with limited frequency response and, usually, more than its share of wow and flutter.

There was considerable surprise, therefore, when the Philips organisation chose this speed for its new cassette equipment. There was even greater surprise when it became apparent that the Company's own record / replay equipment could give a very good account of itself on program material, without obvious wow and flutter and with a response to about 7kHz — a 4:1 improvement on the old rule-of-thumb.

The market reacted most favourably to this, and the cassette system was on its way. Each new generation of tape and tape heads seemed to add another kHz or two to the top end, and a couple of years ago, the cassette system was knocking loudly on the hifi door, with frequency response, distortion and noise level, and wow content just tantalisingly short of the best disc records.

While improvements in technology tended to benefit tape right across the board, the pressure in the audio sphere at least was obviously to up-grade cassettes to full hifi standards.

At about this stage a new kind of tape made its appearance, one in which the ferric oxide had given place to a coating of chromium dioxide. The new coating promised much better characteristics at the high frequency end, with a solid prospect of improved frequency response and improved signal / noise ratio.

There was some concern about the higher price of chromium dioxide, and some apprehension about its abrasive qualities but these were seen only as temporary problems. Manufacturers were attracted by the performance advantage which the tape offered, and tended to see it as the means by which the cassette system would be upgraded unequivocally to full high fidelity status.

But chromium dioxide tape does have an in-built problem. Because it has higher coercivity, it needs about a 2 to 2.5dB increase in the level of bias and erase current. Additionally, an adjustment to compensation is necessary.

Equipment manufacturers have reacted to this by providing many cassette decks with a "CRO2" switch which effects the necessary changes.

At the same time, however, tape manufacturers have persisted with their attempts to refine and improve ferric oxide tape, with the idea of providing equivalent performance without the need to modify bias, erase and compensation.

In short, a new objective of cassette tape manufacturers has been to equal or beat chromium dixode. They obviously believe that, whatever the fine detail of its formulation, a "standard" tape will have a market

The ED (Extra Dynamic) cassette is the top of the very successful line of TDK tapes, marketed in Australia by Convoy Imports. The ED cassette is available in the C-40 configuration, on a polyester base of 18 microns for the first two and 12.5 microns for the C-90.

advantage over one which requires special accommodation in the equipment.

While there is much secrecy in the tape manufacturing field, it is fairly evident that the major manufacturers are working along parallel, if independent, lines. A number of special high performance ferric or neo-ferric tapes have been released recently, including the TDK "ED" (extra dynamic) variety marketed in Australia by Convoy Imports, 84 Nicholson St, Wolloomooloo, NSW.

TDK publicity credits the performance to the use of "pure black magnetite" which is "the first magnetic substance recorded in history — lodestone." More prosaically, our technical dictionary suggests that magnetite is an oxide of iron, ferrosoferric oxide, FE304.

But whether described in romantic or prosaic terms, TDK's ED magnetite tape has already gained an excellent reputation around the world. It recently emerged with top marks among a variety of cassette tapes, on the American market, tested by "HiFi Sound" magazine.

The magazine reported: "Overall best performance under these test conditions was from the TDK ED range, which showed considerable performance advantages which would be probably accentuated with an optimally adjusted machine."

Two more high performance tapes have been announced locally during the past month. One, as pictured, comes from EMI, whose name has appeared on tape and tape equipment almost from the time there was such a thing. Known as "Capitol 2" the new cassettes are described in terms which are unimpeded by modesty:

A Certron chromium dioxide cassette, for those who can take advantage of this formulation. The obvious alternative is the new Certron Gamma series, mentioned in the text.

"Capitol have found a way to perfect iron-oxide tape.

"They've come up with a tape that outperforms chromium dioxide and cobalt energised tapes in many ways, yet retains all the inherent advantages of iron-oxide formulations.

"In fact, Capitol 2, as it is known, is the World's first low-print, high-output, low-noise tape. It also happens to have the World's best dynamic range."

The literature goes on to draw attention to the smoothness of the tape and the improved low-friction cassette that safeguards the tape, is less likely to jam, and so on.

Doubtless, other cassette manufacturers might suggest that the properties are not quite as unique as EMI would like the customer to believe; but there is little doubt that the Capitol 2 cassette is a fine product and in line with what engineers like to call "the state of the art." If you want to know more about Capitol 2 tape, contact EMI in your home state.

The second specialty tape released this month is in the "Certron" range, marketed in Australia by Goldring Engineering (A'Asia) Pty Ltd, 28 Ricketty St, Mascot NSW 2020.

The range includes four grades of cassette tape: "Standard," the least expensive; "Pro Series," median price; "Gamma," top of the line ferric oxide; "Chromium Dioxide," for those who prefer this formulation.

Tests were performed on these tapes by Louis A. Challis and Associates Pty Ltd, which summarised its findings as follows, having particular reference to the "Gamma" range:

"The drop out performance of each tape was evaluated as the low speed level recordings were produced. Without exception, these tapes exhibited comparable performance with all other tape samples tested at the same time. The Gamma series (90 and 120) provide a measurably better performance in terms of drop out than either of the other Certron series or the Chromium dioxide tapes tested.

"Tape linearity was evaluated and the Certron Gamma series provides excellent linearity, whilst the standard Certron series and Chromium Dioxide series provide good linearity.

"Certron Gamma 90 tape provides a good frequency response. At —10VU this response is +0 —3dB from 20Hz to 16kHz, and at —20VU it is +2½ —2½dB from 20Hz to 20kHz.

"The frequency response of the Certron Gamma 120 at —10VU is +0 —3dB from 20Hz to 16kHz, and at —20VU is +3dB from 20Hz to 20kHz.

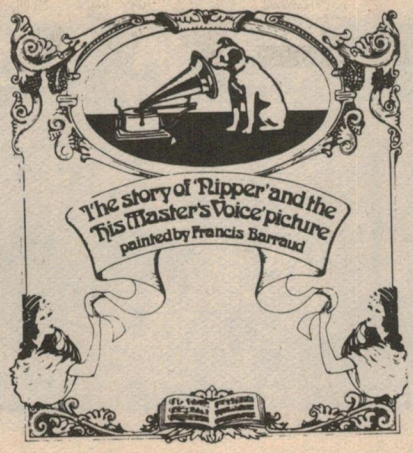
"At —10VU Certron C90 chromium dioxide tape provides a frequency response of +0 —3dB from 25Hz to 14kHz, and at —20VU of +0 —3dB from 20Hz to 20kHz.

"These tapes when used with normal machines should provide an excellent performance, and the Certron Gamma series could provide an exceptional performance, particularly when the macine used has a frequency capability extending above 12kHz."

Further tests carried out by Louis Challis emphasised the progress that has been made in modern tapes in respect to the ability of the base film to withstand high ambient temperatures.

A sample Certron cassette showed no adverse reaction to 75 degrees C.

75th birthday for EMI's little dog



The cover design of the new book

Probably the best known dog ever is "Nipper", the subject for the famous symbol: "His Master's Voice".

The Gramophone Company (EMI) which owns the symbol, has recently celebrated its 75th anniversary and, to coincide with the event, a new book has been published which tells the story of Nipper.

The original of Francis Barraud's painting hangs in the Boardroom at EMI house in Manchester Square. But the full story of how the painting was discovered only came to light recently when someone, researching the history of Britain's talking machine industry, came across it in the Public Records Office.

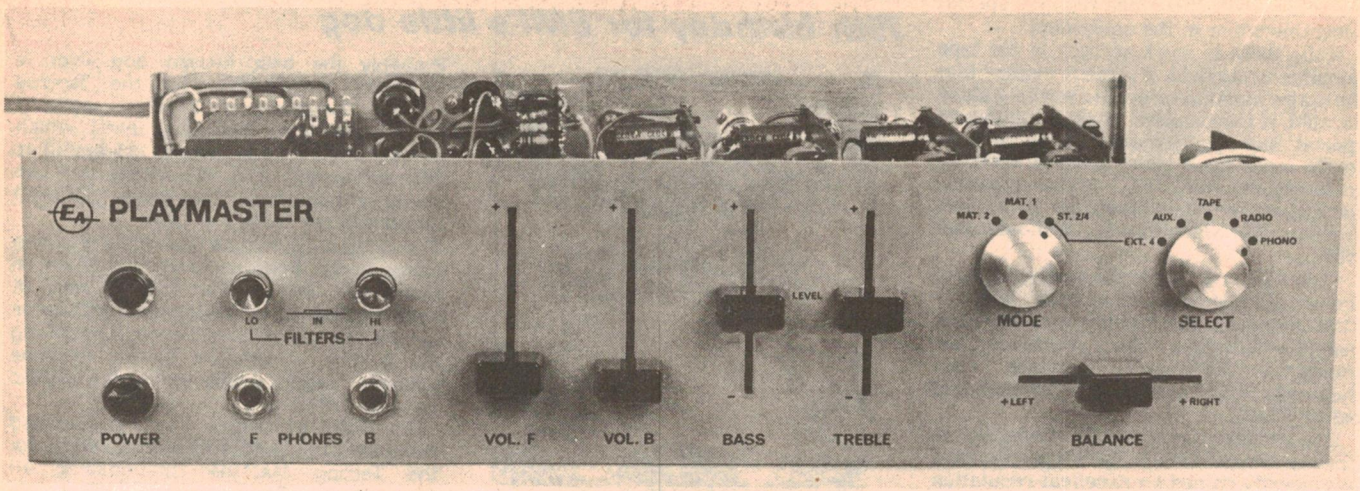
"The Story of Nipper . . ." by Leonard Petts has been published by Ernie Bayly for the Talking Machine International, 19 Glendale Rd, Bournemouth, BH6 4 JA, England at 85p.

Scheduled for release shortly is this most interesting stereo-mono cassette player by Sony: model TC156. Styled as a portable player, it will operate from either mains or internal batteries, the weight being a modest 8lb 5oz or 3.8kg. As a deck, it will record and replay full stereo. As a portable player it has one power channel with a control to select or blend the stereo channels. Recommended retail price will be $209.00.

KENWOOD SHOWROOM

Reg Hall, Jacoby Mitchell's Audio Visual Divisional Manager hosted some 30 of Sydney's leading HiFi retailers at a drinks and buffet grand opening on October 31. On show was a most comprehensive range of Kenwood gear, including the new quadraphonic models KR 5340 and KR 6340. The latter is compatible for both CD4 and SQ.

The new showrooms are conveniently located on street level at 237 Pacific Highway, North Sydney.



Beat rising prices with our new . . .

PLAYMASTER 140

With this article, we begin the description of a high fidelity quadraphonic amplifier, which should be a worthy successor to our very popular stereo Playmaster 136. With in-built synthesising and decode facilities, the new Playmaster 140 also has facilities to accept "discrete" 4-channel signals from tape or CD-4 discs.

by NEVILLE WILLIAMS

We have been tossing about the idea of a do-it-yourself quadraphonic amplifier ever since the 2-channel 136 amplifier made its appearance in December last. The power amplifier modules which it involved and the simple decoder which we had described in the preceding issue clamoured to be put together into a 4-channel unit, and we made a few preliminary moves in this direction earlier in the year.

But, as often happens, we ran into problems of supply and approach which caused delay. Commercial amplifiers often use a master 4-gang volume control in association with a "joystick" pot system for balance. We could have obtained such items for our prototype but the supply position turned out to be dubious in the months ahead. Similarly for some of the other items. Weeks slipped by as we — and the various suppliers — waited for information.

Again, the more we looked at the project, the more we became convinced that easy answers were not necessarily the most appropriate ones. Constructors, facing up to a four channel amplifier, might want to avoid undue complication and expense but, at the same time, may not welcome too many compromises. A worthwhile design would have regard to future as well as present needs.

A variety of control and access and layout configurations were devised and discarded before we settled upon the one finally adopted.

As far as possible, it avoids specialised components, devious circuitry and constructional methods that would present problems to the homebuilder. At the same time, the approach and styling is modern, and there is opportunity to adapt to changing ideas and techniques.

We have not had opportunity to cost the complete amplifier but we tip that it will relate to the quadraphonic amplifier market in much the same way as the 136 Playmaster did to 2-channel commercial amplifiers — very attractively!

At this point in the article, we would normally refer to the main circuit diagram and use it to explain our general approach. We can't do that on this occasion, because the circuit diagram of a complete quadraphonic amplifier is hard to draw and hard to read, particularly if compressed into the available page area.

Instead, we plan to rely on block and functional diagrams which, hopefully, will contain a lot of information of constructional value. The basic circuit lumps around which the amplifier is built are regarded as modules, each one to be the subject of separate presentation in subsequent issues.

Not only should this simplify construction of the amplifier as a whole, but it will meet the needs of those who may want to tackle the project in stages. For example, by providing just the preamp. board, two power modules and the power supply, the amplifier could be operated as a normal 2-channel stereo system, virtually identical in performance to the Playmaster 136. The additional channels and facilities could be added, as they are needed, or as finances permit.

But, before proceeding further, the simple diagram opposite indicates the positions assumed for the four loudspeakers and the coding adopted to identify them. When ultimately building the amplifier, you will need to be constantly alert to avoid getting the channels mixed up. Different coloured wiring will help, but we have also tried to build into the layout and diagrams a logical clockwise progression which is: front left; front right; back right; back left.

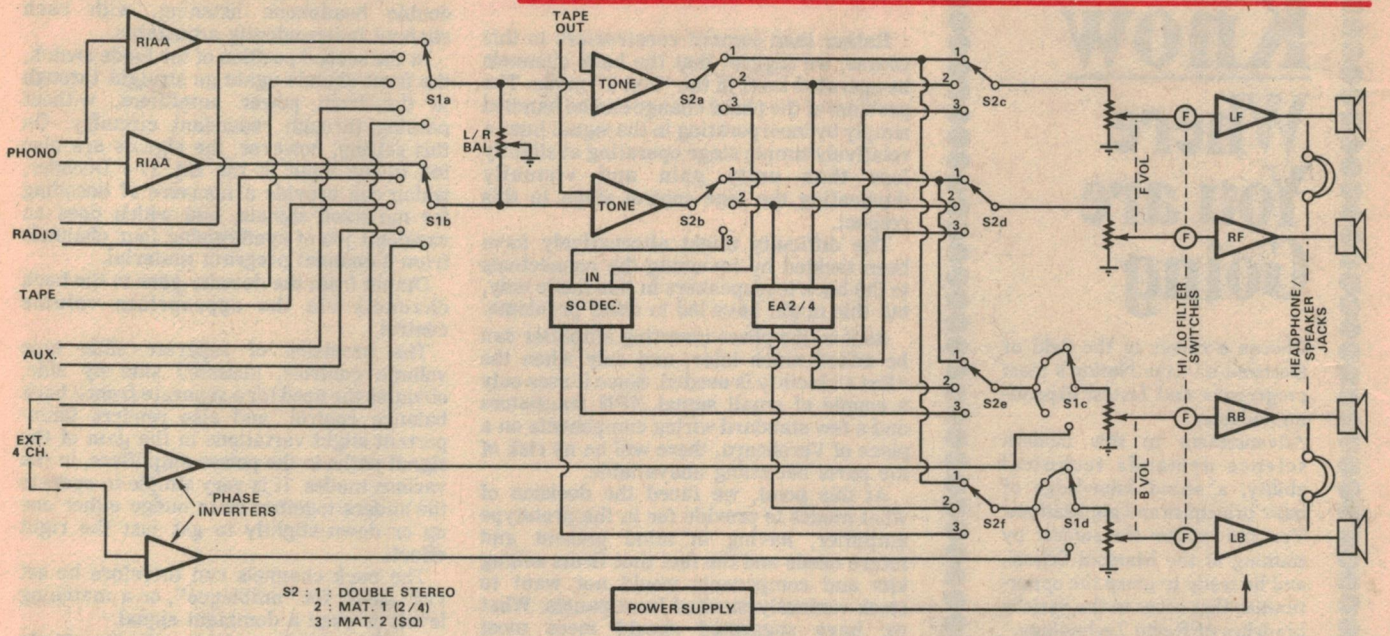
Perhaps we should add that the listening room need not be as regular or as bare as the diagram seems to suggest. One of the attractions of quadraphonic sound is that it can fill a listening room with pleasantly dimensioned sound, without being overmuch inhibited by the shape of the room or the disposition of other furniture. It is, in fact, a good deal less demanding in this respect than ordinary 2-channel stereo.

The general approach adopted in the Playmaster 140 is best appreciated by examining the accompanying block diagram.

A series of DIN sockets on the rear of the chassis accepts inputs from five possible sources: magnetic phono pickup, feeding directly into a preamplifier compensated for RIAA characteristic; radio, either mono or stereo; external stereo tape player, providing it has its own preamp/-compensation; auxiliary, either mono or stereo; external 4-channel source, providing it has its own low-level circuitry.

We shall have more to say later about the

BASIC PLAN OF THE NEW AMPLIFIER



The new Playmaster 140 is pictured at the top of the facing page. From the front it looks much like any other amplifier but it will cope with present requirements and should be readily adaptable for future needs.

Because a full schematic circuit would be difficult to present and to read, our explanation of what the Playmaster 140 is all about is based on this simplified diagram. In particular, it shows the signal routing and switch functions involved for the various modes of operation. It will be helpful also, if you wish to modify the wiring to provide alternative options.

external 4-channel input.

The precise sensitivity at the various inputs will vary somewhat with component tolerances and with operating mode. However, in general terms, the specification for the phono input is 2.0mV minimum into 50k Ohms for full output. This will more than meet the needs of current magnetic cartridges.

Other input channels present an impedance of approximately 0.5 megohm and require an input of nominally 150mV for full output. These again are convenient and conventional figures.

On this occasion, we have not sought to make specific provision for ceramic phono cartridges, since magnetic types are now virtually universal in the high fidelity field.

The desired input is selected by a 5-position "Select" switch marked as S1a and S1b. The switch has two other poles which we shall also refer to later but, otherwise, this much of the circuitry is conventional.

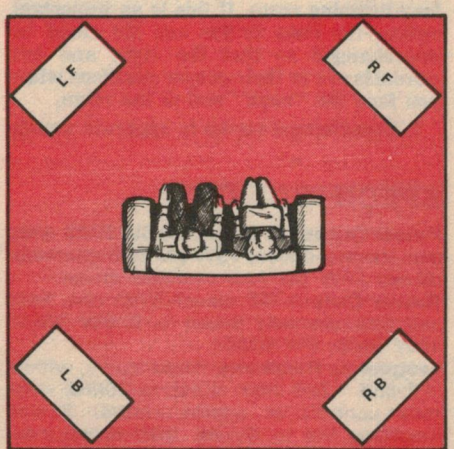
Conventional also is the left / right balance potentiometer which follows the Select switch, and the "Tape Out" provision from this same part of the circuit. Made available via the Tape DIN socket already referred to, the tape output allows material to be copied from the amplifier, without being subject to the amplifier's volume and tone controls.

The tone controls employ conventional bass and treble cut and boost circuitry which can modify signals arriving via any one of the 2-channel stereo inputs. They are therefore effective for anything derived from these sources, including normal 2-channel stereo, simulated quadraphonic, or matrixed quadraphonic.

Output from the tone control stages passes to two poles of a "Mode" switch, designated as S2a and S2b. Some of our earlier effort was aimed directly at avoiding the need for such a switch and we had a scheme worked out involving interchangeable plugs at the rear of the chassis, which would have been readily adaptable to future needs. But who wants to fiddle with plugs behind a chassis, when changing from one mode of operation to another? Whether by a socket system or a mode switch, the operating mode will almost certainly need to be changed, perhaps more than once in a typical listening session.

Output from the various signal sources may need to be directed to the power amplifiers for straight-through 2-channel stereo, or it may need to be diverted to one or other of the synthesising or decoding systems, either in-built or external.

The Mode switch therefore needs to direct the available signal to the circuit which is to receive it while, at the same time, the power amplifiers have to be switched to pick up their signal from that source. Poles S2a and S2b perform the first function, while poles S2c, d, e & f operate at the respective inputs of the power amplifier modules.



The layout and coding of the amplifier assumes that the loudspeakers and the channel wiring is in an order beinning with left front, and progressing clockwise around the room.

Before proceeding, it would be appropriate here to refer to the additional poles on the Select switch S1c and S1d, which relate to the provision for external 4-channel input. Such a provision is necessary if the amplifier is to cope with discrete 4-channel signals which might typically be derived from a tape deck or from a future CD-4 record playing deck and demodulator.

The front channels present no problem, since they can be handled by S1a and S1b and fed through to the appropriate left and right front power amplifiers.

The back channels, on the other hand, have to be fed to the respective power amplifiers which, in all other modes, derive signals extracted from the "front" 2-channel sources. Thus the Select switch has to carry two extra poles so wired that, in the "Ext 4" position, the power amplifiers driving the back loudspeakers are connected through to the "Ext 4" signal source.

But the problem doesn't quite end here. The "front" signals pass through the tone control board, and we would not want it any other way; it retains the bass / treble control facility, but it does introduce a 180-degree phase change in the signal.

A seemingly obvious course would be to duplicate the tone control facility, but this is one area where we accepted compromise. Duplication would apply only for the back channels and only with discrete input signals. And, coming from the latest technology sources, these would hopefully be the signals least likely to need "doctoring".

The price would be duplication of the entire tone control circuitry, including the provision of additional and expensive ganged potentiometer elements.

PLAYMASTER 140

Rather than commit constructors to this course, we suggest that the back channels be operated level in the "Ext 4" mode. The problem of the phase change can be handled simply by incorporating in the signal lines a relatively simple stage operating at slightly less than unity gain and virtually duplicating the tone control stage in this respect.

The difficulty might alternatively have been tackled by reversing the connections to the back loudspeakers in this mode only, but this might have led to other problems.

As it is, the phase inverting amplifier can be added much later, and only when the "Ext 4" facility is needed. Since it uses only a couple of small signal NPN transistors and a few standard wiring components on a piece of Veroboard, there will be no risk of the parts becoming unavailable.

At this point, we faced the decision of what modes to provide for in the prototype amplifier, having in mind present and future needs and the fact that firms selling kits and components would not want to stock variously marked front panels. What we have suggested should meet most requirements, while retaining a large element of flexibility.

In the fully clockwise position of the Mode switch (the position as drawn) the signal from the tone control stage is directed straight through to the front left and right power amplifiers via a 2-gang slide volume control. Using this much of the system, the amplifier works as a conventional 2-channel stereo unit, with no redundant circuitry in the line, and no "blend" to deteriorate left / right stereo separation.

The same pair of signals is made available to the back channel amplifiers via a second 2-gang slide volume control.

You will note that phone jacks are provided so that the front and back amplifiers may optionally feed pairs of loudspeakers or stereo headphones.

Taken together, the foregoing paragraphs add up to a range of useful options in this first position of the Mode switch:

1. Double stereo in the one room, with balance determined by the volume control settings.

2. Two-channel stereo at either end of a long listening room. If this is an important option, the links to S2e and S2f could be interchanged so that the right and left channels are in their proper positions when you face the "back" end of the room.

3. Two-channel stereo in separate rooms with the level of each controlled by its own "front" or "back" potentiometer.

4. Mixed loudspeaker and headphone, or double headphone listening, with each channel independently adjustable.

In the second position of the Mode switch, the front signals again go straight through to the front power amplifiers, without passing through redundant circuitry. On this setting, however, the signals are also fed to the input of the EA 2 / 4 Decoder, which can provide a measure of decoding for matrixed signals, and which does an excellent job of synthesising four channels from 2-channel program material.

Output from the decoder goes to the back channels via the appropriate volume control.

The provision of separate slide type volume controls, mounted side by side, obviates the need for a separate front / back balance control, and also renders unimportant slight variations in the gain of the signal paths to the power amplifiers, in the various modes. It is very simple to operate the sliders together or to nudge either one up or down slightly to get just the right effect.

The back channels can therefore be set very easily for "ambience", or a matching level, or even a dominant signal.

On the third position of the Mode switch, the signal is routed via a basic SQ decoder, about which we will say more later. This is the position you will normally choose for SQ encoded discs; you may or may not prefer it for other discs or for synthesised effects.

Quite deliberately, we have avoided marking the panel in a specific way. Instead, position 1 is marked "ST 2 / 4", the others "MAT1" and "MAT2".

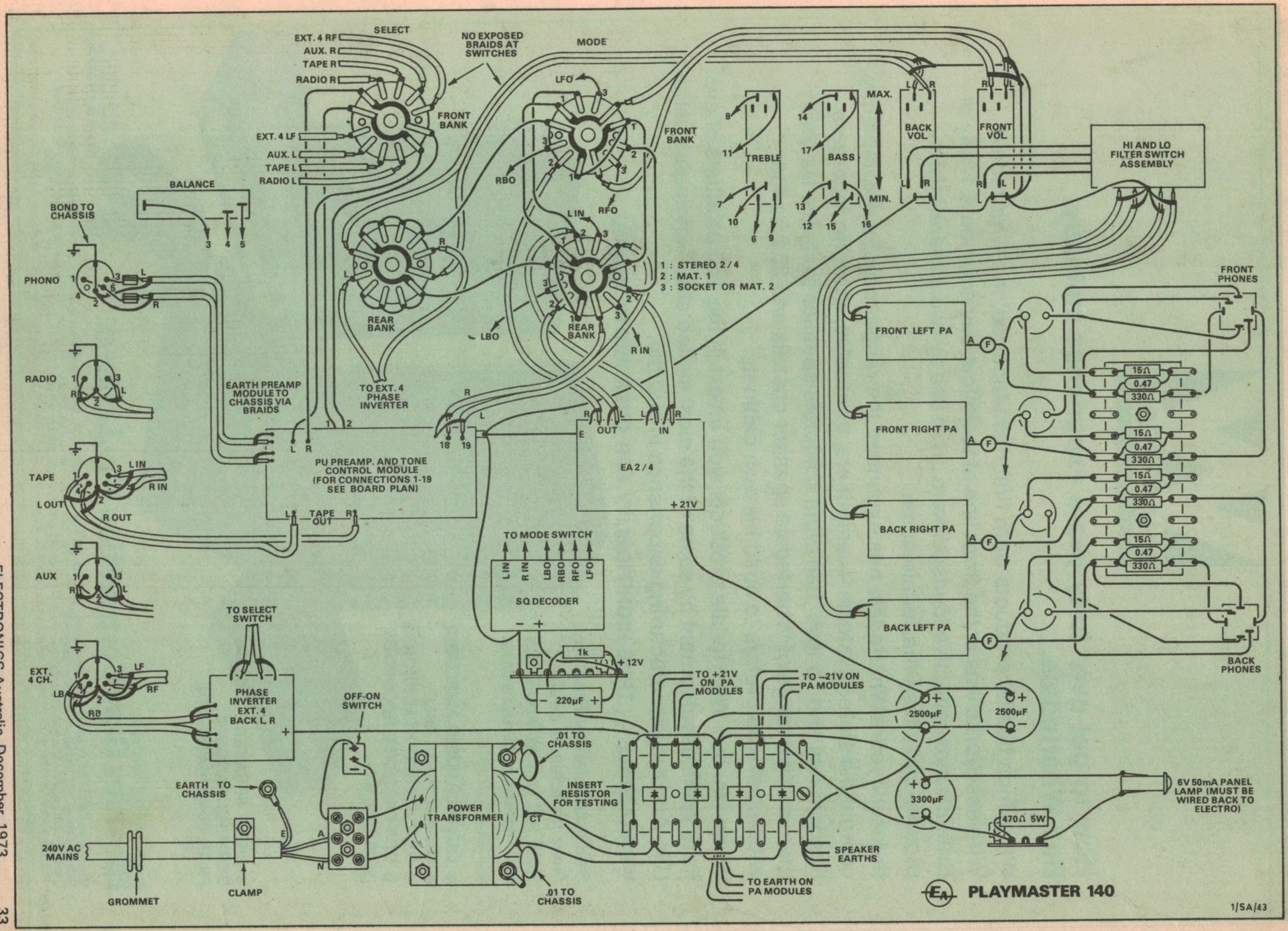
The "ST 2 / 4" position is the appropriate one to select for straight 2-channel stereo and also for discrete quadraphonic, when the Mode switch is set to "Ext 4". For this reason, we have wired the switches so that the "ST 2 / 4" and "Ext 4" positions are adjacent and easily bridged by a line drawn on the panel.

In fact, if you are not interested in the double stereo facility, the 2 / 4 decoder can be wired to this first position. The labelling

The diagram on the facing page should be invaluable when you are actually constructing the new amplifier. It shows details of the input and switch wiring; loudspeaker, phones and power supply connections. Note also the sequence of earth wiring, which should be studied in conjunction with the text. Details of the preamplifier, power and decode modules will be given in subsequent issues.

SPECIFICATIONS

Power Output (8 ohms): 16.5W RMS with one channel driven; 15W per two channels driven; 14W per four channels driven.
Power Output (16 ohms): With one, two and four channels driven — 10.5W RMS, 10W RMS, 9W RMS.
Frequency Response: As per curve, within +2 and –2dB from 20Hz to 20kHz with tone controls at approx centre. Power amplifiers flat to 60kHz, then deliberately rolled off.
Compensation: RIAA for phone input. Other inputs flat.
Sensitivity: Magnetic phono, 2mV into 50K nominal for 15W RMS output. Other inputs, 150mV into 500K nominal.
Signal / Noise Ratio: Better than 60dB for all inputs, tested with input circuits open.
Cross-Talk: Better than 44dB at 1kHz for all channels with typical sources connected to the inputs.
Distortion: THD at 1kHz and max rated power 0.6pc. At typical listening levels (incl noise component) 0.4pc.
Bass, Treble Controls: Nominally +14dB and –18dB at 50Hz and 10kHz. (See curves).
Filters: –14dB at 20Hz and 10kHz.
Stability: Tested and stable into capacitance values across load up to 2uF.


SELECT
EXT. 4 RF
AUX. R
TAPE R
RADIO R
NO EXPOSED BRAIDS AT SWITCHES
MODE
FRONT BANK
EXT. 4 LF
AUX. L
TAPE L
RADIO L
LFO
RBO
RFO
LIN
LBO
R IN
REAR BANK
BALANCE
BOND TO CHASSIS
PHONO
RADIO
TAPE
L OUT
R OUT
AUX
EXT. 4 CH.
LF
RF
LB
RB
EARTH PREAMP MODULE TO CHASSIS VIA BRAIDS
TO EXT. 4 PHASE INVERTER
PU PREAMP. AND TONE CONTROL MODULE (FOR CONNECTIONS 1-19 SEE BOARD PLAN)
TAPE OUT
EA 2/4
+21V
TO MODE SWITCH
SQ DECODER
1k
+12V
220µF
TO SELECT SWITCH
PHASE INVERTER EXT. 4 BACK L R
OFF-ON SWITCH
TREBLE
BASS
MAX.
MIN.
BACK VOL
FRONT VOL
HI AND LO FILTER SWITCH ASSEMBLY
1 : STEREO 2/4
2 : MAT. 1
3 : SOCKET OR MAT. 2
FRONT PHONES
FRONT LEFT PA
FRONT RIGHT PA
BACK RIGHT PA
BACK LEFT PA
15Ω
0.47
330Ω
BACK PHONES
TO +21V ON PA MODULES
TO –21V ON PA MODULES
2500µF
3300µF
470Ω 5W
6V 50mA PANEL LAMP (MUST BE WIRED BACK TO ELECTRO)
.01 TO CHASSIS
INSERT RESISTOR FOR TESTING
POWER TRANSFORMER
CT
SPEAKER EARTHS
TO EARTH ON PA MODULES
EARTH TO CHASSIS
240V AC MAINS
GROMMET
CLAMP
PLAYMASTER 140
1/SA/43

is still valid and the straight-through frontal stereo is not prejudiced, since the 2 / 4 decoder does not blend the front channels.

By doing this, or else eliminating the 2 / 4 decoder altogether, a switch position can be cleared to select some other type of in-built decoder that might turn up.

Alternatively, we have provided for an octal or other socket on the rear of the chassis. While we have not actually wired up such a socket, it should be possible to connect to it output from the tone controls and inputs to the power amplifiers, exactly as with the in-built SQ decoder. This done, it should be possible to plug in some future elaborate logic style decoder or a complete external multiple decode facility.

As far as the main amplifier is concerned, all you have to remember is the significance of the markings "MAT1" and "MAT2."

Leaving the switching, you will notice that filters are shown between the volume control sliders and the inputs to the four power amplifiers.

To be perfectly frank, we are not enamoured with the idea of Hi Lo filters of the simple kind, as they usually are. With a slope of 6db / octave, their actual effect is very little different from merely turning down the bass and / or treble response by the equivalent amount. However, Hi-Lo filters are "in" and we have conformed to the trend. Physically, they involve a pair of push-buttons, each of which activate a 4-pole changeover function, sufficient to serve the four channels.

While we may sound rather negative about the provision, there are positive aspects. The buttons are certainly quick and convenient to use and, since they operate symmetrically in all four channels, they would provide a means of suppressing hiss or rumble in the "Ext 4" mode, where the main tone controls operate only on the front channels.

Again, their action is additional to that of the tone controls so that use of both facilities makes available very heavy bass and / or treble cut.

A further point is that, if a constructor has a real need for a special filter contour, the controls are there and he can hang whatever circuitry he likes behind the panel.

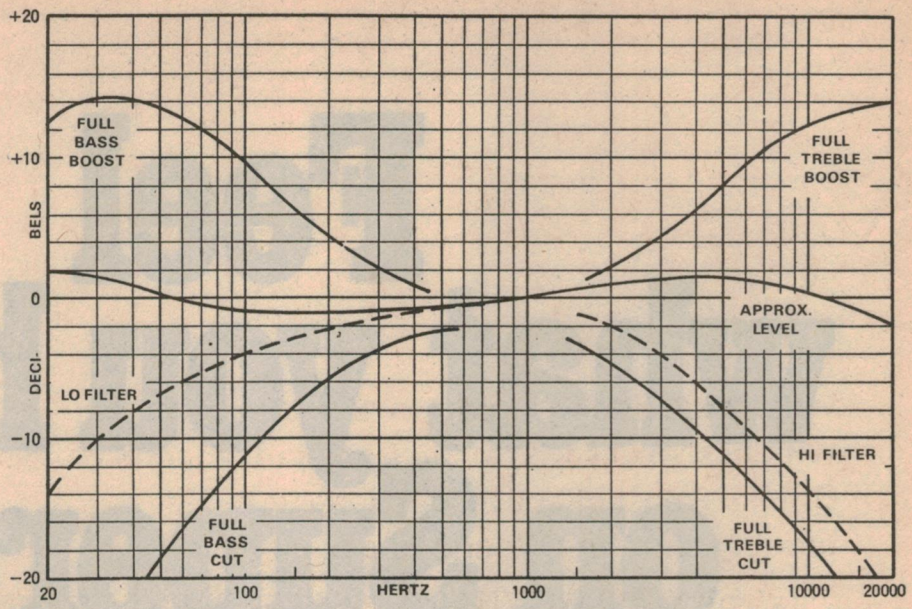
The power amplifier modules themselves are basically similar to those used in the 136 Playmaster but with one vital difference. We have modified the printed wiring board to eliminate the individual sets of rectifiers and filter capacitors. This was a practical scheme with a mono or 2-channel stereo system but not a quadraphonic amplifier, which would have involved eight filter capacitors and sixteen rectifiers. In addition, there would have been an almost certain problem with circulating ripple currents penetrating the input signal wiring and causing buzz at a problem level.

The new Playmaster 140 therefore uses a common — and simple — power supply involving a power transformer, four rectifier diodes and three chassis — mounting electrolytic filter capacitors. This provides the required outputs: common, plus 21V and minus 21V. The supply is unregulated but is adequate, nevertheless. In the prototype amplifier it provided 21.5V under quiescent conditions, falling to 18.5V under the provocative test conditions of all four channels driven simultaneously and held at clipping point.

In terms of power output, this means that channels driven individually can be expected to deliver about 16W RMS, just short of clipping. With all four channels so driven, the figure is likely to be at least 13W per channel, which is the same figure as published for the Playmaster 136. Under ordinary program conditions, it is reasonable to rate the amplifier as 15W RMS per channel, or 60W RMS total.

This is into the recommended 8-ohm loads. We did not run complete tests on the 140 into 16-ohm loads but, based on the 136, the output would probably be in the 8 to 10W region. Operation into 4-ohm loads is not recommended.

As was the case with the 136 amplifier, the 7 transistors in each power module are covered by a special offer by Fairchild Aust Pty Ltd, to "Electronics Australia" readers. At this stage, the offer holds good until March '74, after which the transistors will have to be bought through normal channels at normal (and higher) prices.



Frequency response curves of the prototype Playmaster 140, with the bass and treble controls in the full boost, full cut and approximate centre positions. Minor differences between these and other published curves are due to component variations. The filters have been selected to cut down rumble and hiss, without overmuch affecting typical program material. They can be made more drastic by halving (bass) or doubling (treble) capacitance values.

Authorised Fairchild distributors in Australia are:

NSW: Warburton Franki (Syd) Pty Ltd, 199 Parramatta Rd, Auburn 2144. George Borwn & Co Pty Ltd, PO Box 35, Camperdown 2050.

VIC: Warburton Franki Ind (Melb) Pty Ltd, 220 Park St, South Melbourne 3205.

SA: Gerard & Goodman Pty Ltd, 192 Rundle St, Adelaide 5000.

QLD: Warburton Franki (Bris) Pty Ltd, 13 Chester St, Fortitude Valley, 4006.

ACT: George Brown & Co Pty Ltd, 23-25 Whyalla St, Fyshwick 2604.

WA: Warburton Franki Pty Ltd, 41 Great Eastern Highway, Riverdale 6103.

New Zealand readers can obtain their Fairchild power kits (7 transistors) from Teerad stockists throughout New Zealand.

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Try on a pair of Superex PRO-B VI stereophones and see what happens to your body. It's a physical sensation you can't get with other stereophones. With the PRO-B VI, each earcup contains its own woofer and tweeter, plus a full crossover network.

This permits a glorious rush of music to enter each of your ears and travel right to your toes. The dynamic woofer has double chamber acoustic suspension and damping. So you feel a drum roll down your neck. The coaxially mounted tweeter lets a flute send shivers up your spine. And in each ear, you feel the range and purity of a 15-22,500 Hz frequency response. 4-16 Ohm impedance.

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Dynamic Woofer/Tweeter Stereophones
Sugg. Retail Price $68.00.

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Superex Electronics Corp., 151 Ludlow St., Yonkers, N.Y. 10705. Distributed in Australia by Jervis Aust P / L, PO Box 6 Brookvale, NSW 939 2922.

PLAYMASTER 140

To take advantage of the offer, readers should complete the coupon herewith and forward it, with the appropriate remittance, to one of the authorised Fairchild distributors listed along side.

Fairchild stress that the coupons must not be sent direct to Fairchild Aust, nor will the company enter into technical correspondence about the transistors. Equally, they are not available from "Electronics Australia".

The prices quotes are nett and there is no provision to supply the "offer" transistors at lower prices to users who can claim exemption from sales tax for any reason.

Depending on circumstances, suppliers of complete amplifier kits may or may not be able to include the Fairchild special offer pack in their kits. If not, constructors will have pick up or write for the special offer packs individually.

So much then for the broad concepts of the amplifier. What about the problems of constructing it?

Basically, we have tried to keep in mind the needs of the home builder and it may be relevant to say that the prototype was actually developed and constructed in the home situation during evenings and weekends. Most copies will typically be produced in the same situation, with the difference that individual constructors will be able to follow pictures and diagrams, rather than have to work out the tedious detail for themselves.

We have done our best to assist, in this regard, in the space available, but we must warn that construction of the complete amplifier is a fairly formidable task, and one that will absorb a lot of hours. If you have successfully constructed a normal stereo amplifier, such as the 136 Playmaster, you should be able to cope with the 140. But don't tackle it as your first substantial electronics project; it's too big a job for that.

If you do decide to "have a go", you'll need to pay plenty of attention to the main wiring diagram, into which we have tried to cram a lot of essential information.

First point of interest is the wiring to the DIN input connectors. It differs from that in the 136 but, to the best of our knowledge conforms to current "standards". The connectors are drawn looking on the socket tags but, if you are in anyway confused, work to the numbers which are usually moulded into plugs and sockets alike.

In the case of the phono socket, pins 1 and 5 are bridged, allowing either a 3-pin or a 5-pin plug to be used. The chokes, intended to combat radar or other RF interference, involve a couple of ferrite RF beads, typically 3.5mm diameter and 5mm long. Loop about 5 turns of thin enamelled wire though the beads; anchor the chokes between pins 3 and 5 of the socket and a tagstrip secured to the socket mounting screw.

All signal wiring from the input sockets to the rest of the circuitry should be carried out in figure-8 shielded wire with outer PVC covering, to prevent random contact between the shield and chassis.

It is absolutely essential to follow the earthing procedure suggested in the diagram. Failure to do so will almost certainly result in hum problems and possibly instability as well.

Looking again at the phono input, the socket shell and pin 2 are shown earthed to the chassis at this point. The intention is that the incoming phono leads be earthed where they enter the amplifier chassis and that the internal circuitry be earthed back to — and only to — this same point.

As a first step to this objective, the braids of the figure-8 leads running back to the preamplifier input should be earthed to pin 2 of the phono socket and also to the earthy pattern of the preamplifier board. When you ultimately mount this board on its pillars, you will have to make sure that the pillars and / or screws are clear of the copper pattern.

For the sake of simplicity, all other input sockets can be wired with the braid joining to pin 2 and thence to the earthed shell. However, there is one vital difference: whereas the braids from the phono socket join to the preamp earth pattern, the braids from the other sockets go nowhere at the far end.

When it is time to terminate these leads, split the figure-8 as necessary and snip them to the required length. Now, with a razorblade, cut through and remove about ½in of the outer sleeve. Pull the remaining outer sleeve back, snip off the exposed braid and let the PVC covering slide back into place. Only the inner conductor should now be visible, which can be stripped and soldered to the appropriate circuit point.

This procedure is necessary to avoid creating earth "loops" or parallel earth paths. It also makes the wiring to the switches much easier because you are concerned only with the inner conductors. The shield ends somewhere back inside the PVC covering.

In short, no shields whatever are terminated or interconnected at the switch banks. The shields have to be earthed, of course, but this is done at the remote ends, where it is usually more convenient.

The wiring to the switches is probably the most tedious part of the whole job and the one where you are most likely to make mistakes. The switches are drawn in the same "ST 2 / 4" position as shown in the preceding diagram, and for the same options. If you choose to vary from these, you will have to work out the revised connections for yourself.

The figure-8 shielded wire we used had red and white inner conductors and, in an effort to minimise confusion, we adopted the convention throughout all the signal channels of "red equals right".

Also, because we weren't convinced

BUILDING THIS AMPLIFIER

Because this is a fairly complex project, and one that we want to present in some detail, the description is likely to extend over at least three issues. This being so, it will take suppliers some time to organise supplies and price quotations. But we believe that the result will be worth waiting for.

Nest month, we plan to describe assembly and wiring of the basic chassis, as depicted on page 33, ready to receive the various modules.

These include the main power modules, the preamp tone control (similar to that in the 136), the 2 / 4 decoder (Nov '72), the filter assembly and a completely new item, the SQ decoder.

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about our own infallibility, we made a point of approaching the switch contacts with a loop in the leads, so that there was generally a small length of lead in reserve. It also allowed us to thread the leads past one another a little more easily and to push leads out of the way of the hot iron tip.

From the phono input socket, through the phono shield braids to the input end of the preamp board, the earth path is through the copper pattern to the output end of this same preamp / control board. In fact, we secured a solder tag to the corner of the board adjacent to the volume controls and this can become the earth reference point for all the circuitry just ahead of the main power modules.

The decoders earth back to this point, as also do the volume controls and the input circuits to the power modules. As the diagram indicates, we used shielded wires for the signal leads to the 2 / 4 decoder, because it is mounted well away from the switches; non-shielded leads will suffice for the SQ decoder, which sits in a socket very close to them.

From the volume controls, the active and earthy signal leads run to the filter block, which will be detailed later, and thence to the respective power modules.

The output circuit from the power modules involves a lot of wiring, mainly because we have again followed commercial trend and provided stereo output phone sockets for both front and back channels. The sockets are wired so that plugging in the phones automatically disconnects the particular pair of loudspeakers.

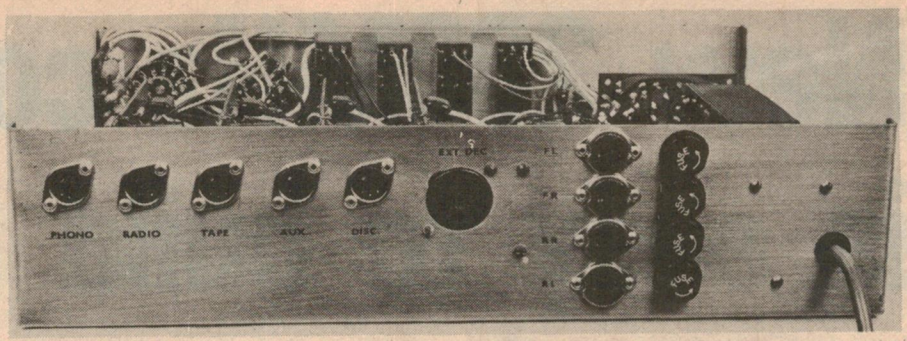
This involves the provision of stereo phone sockets in which the loudspeaker switching function is electrically isolated from any part of the phone circuit. The phones themselves are fed through series resistors, which should limit the available power to a convenient level, almost irrespective of the impedance of the phones. However, if you need more level in the phones, the resistors can be reduced in value.

As indicated in the wiring diagram, the phone series resistors and the parasitic suppression components for each channel can conveniently be mounted on a tagboard attached to the inside rear of the chassis, alongside the fuses.

While one side of the loudspeaker output circuit is nominally at chassis potential, it is essential that there be no DC path to the chassis, except via the copper pattern on the power modules and thence through the earth wiring already described. The phone socket does earth direct to chassis, for the sake of convenience but this is permissible because of the high impedance of the phone output circuit.

The same remark about earthing paths applies to the power supply, the only direct earthy path being through the RF bypass capacitors, which are there to help shunt any mains-borne RF direct to chassis. The actual DC output (common, plus and minus) runs through separate leads to each power module. Thus, while the power supply common is at nominal chassis potential, it is so only by virtue of the path through the amplifier chain back to the phono input socket.

It is important to note that the earthy side of the loudspeaker wiring returns directly to the filter capacitors. This minimises the flow of output stage current through the earth link from capacitor to module, and the resulting IR drop which would be imposed across the input circuit braid. It prevents amplification of any hum component and minimises crosstalk between modules.



The rear panel of the Playmaster 140. To avoid confusion, the channel marked DISC (Discrete) has been renamed "EXT 4".

As already mentioned, the power supply itself is a very simple arrangement. The power transformer is rated at 15V per side at 2A (Ferguson PF3588 or similar). This feed into two pairs of rectifier diodes which we mounted, for convenience, on a small tagboard. The tagboard also serves as a convenient distribution point for the DC wiring. Note that there is provision for a link in the transformer CT return. A resistor of 15 to 20 ohms at 5W between the link points can limit the currect in the case of an accident during the initial testing. It must, of course, be replaced by a wire link once the amplifier is provisionally operational.

The filtering relies on three electrolytics which provide 3000uF across the —21V supply and 5000uF across the +21V supply The ones shown in the photograph are chassis mounting Elna types rated at 35V, and respectively 2500 and 3000uF. (We understand that the 3000uF type will ultimately be superseded by a 3300uF type, which is all to the good.)

They reduce the ripple level to a faint hum which is just audible if you hold your ear directly in front of the loudspeaker(s); this with compact systems of average sensitivity. If your loudspeakers are more than usually sensitive, or if you want to reduce the hum to an academic level, more capacitance can be added to the +21V line in particular. Whether this takes the form of an additional capacitor or high capacitance units which may turn up in somebody's catalogue is immaterial.

One final point: Note that the indicator lamp is wired back to the common line. Even though it is nominally a DC circuit, you will find yourself with an hum loop problem if one side of the lamp returns to chassis.

(To be continued)

New 200MHz counter is easy to build & drive

Here is a new design for a 200MHz frequency counter. It is fully solid state, using the latest MSI integrated circuits and LED readouts. And the really good news is that not only is its performance much better than previous designs, but it is smaller, lower in cost and far easier to build and use!

by JAMIESON ROWE

In March 1970, you may recall, the author described a fairly basic 200kHz frequency counter. This was followed in May 1970 by a 70MHz design, based on the same counting circuitry. Both used gas-discharge readout tubes, together with circuitry based on RTL, DTL and ECL integrated circuits.

I think it would be reasonable to claim that these designs were close to the "state of the art" at that time, considering them in the context for which they were designed. They used the highest-performance devices then readily available at reasonable cost, were not unduly complex or difficult to construct, and gave a standard of performance which was more than adequate for most frequency measurements of the type made by radio amateurs, hobbyists and service technicians.

On the other hand, I am the first to admit that they were not particularly low in cost, nor easy to build, compared with other electronic projects. The 70MHz design involved a component cost of about $200 when described, involved some 43 ICs and more than a dozen discrete transistors and diodes, and used no less than three large and one small printed boards. Obviously, these were projects somewhat more complex and costly than a simple radio receiver or stereo amplifier — and of course this was the way it had to be.

But over the last three years the situation has changed, as many readers will be aware. Big advances have been made, particularly in the field of digital ICs. The performance of available devices has been increasing steadily, while the prices have tended to fall. As a result, it is now possible to produce a digital counter using far fewer ICs than before, and at a significantly lower cost.

In the new counter design presented here, I have tried to take full advantage of the new devices available. At the same time, I have consciously tried to produce a counter which would be easier to build than before, and also easier to operate. I think these aims have been achieved with reasonable success.

Here are the features it offers. The basic counter is four decades with over-range — ie, "4½ decades," one full decade more than the earlier designs. It counts to above 20MHz, but this is extended to beyond 200MHz using an optional internal prescaler. The counting decades have readout storage, another feature not provided on the earlier designs. Readout is via 7-segment LED displays, with blanking of leading zeroes. Over-range readout is via two low-cost LEDs, positioned to simulate a "1." Provision has been made for optional addition of overflow indication and blanking control.

The internal timebase frequencies are provided by a crystal oscillator operating at 2MHz, in conjunction with a divider chain. Any of the timebase signals may be made available for calibrating the counter, as desired, even while measurements are being made. The signals may also be used for calibrating receiver dials and other purposes.

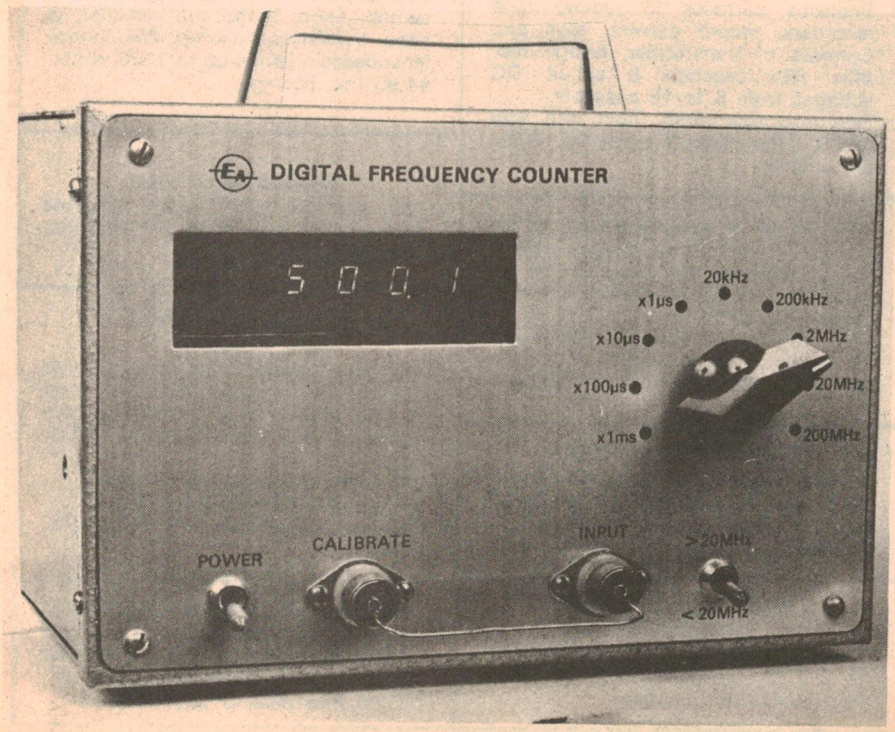
The circuit features a novel internal "housekeeping" system, which automatically adjusts the measurement rate according to the frequency range in use or the time period being measured. This completely obviates the need for a "sample rate" control as fitted to the earlier counters, making the instrument considerably easier and less confusing to operate. At the same time, measurements are not restricted to a single low rate, as found on some simpler counters.

No provision has been made for single measurements under manual control, nor is there provision for event counting under manual control. Similarly there is no input sensitivity adjustment, the input sensitivity being fixed at maximum. All of these semi-traditional counter facilities have been omitted in the interest of simplicity, experience with the earlier counters having shown that they are only rarely used.

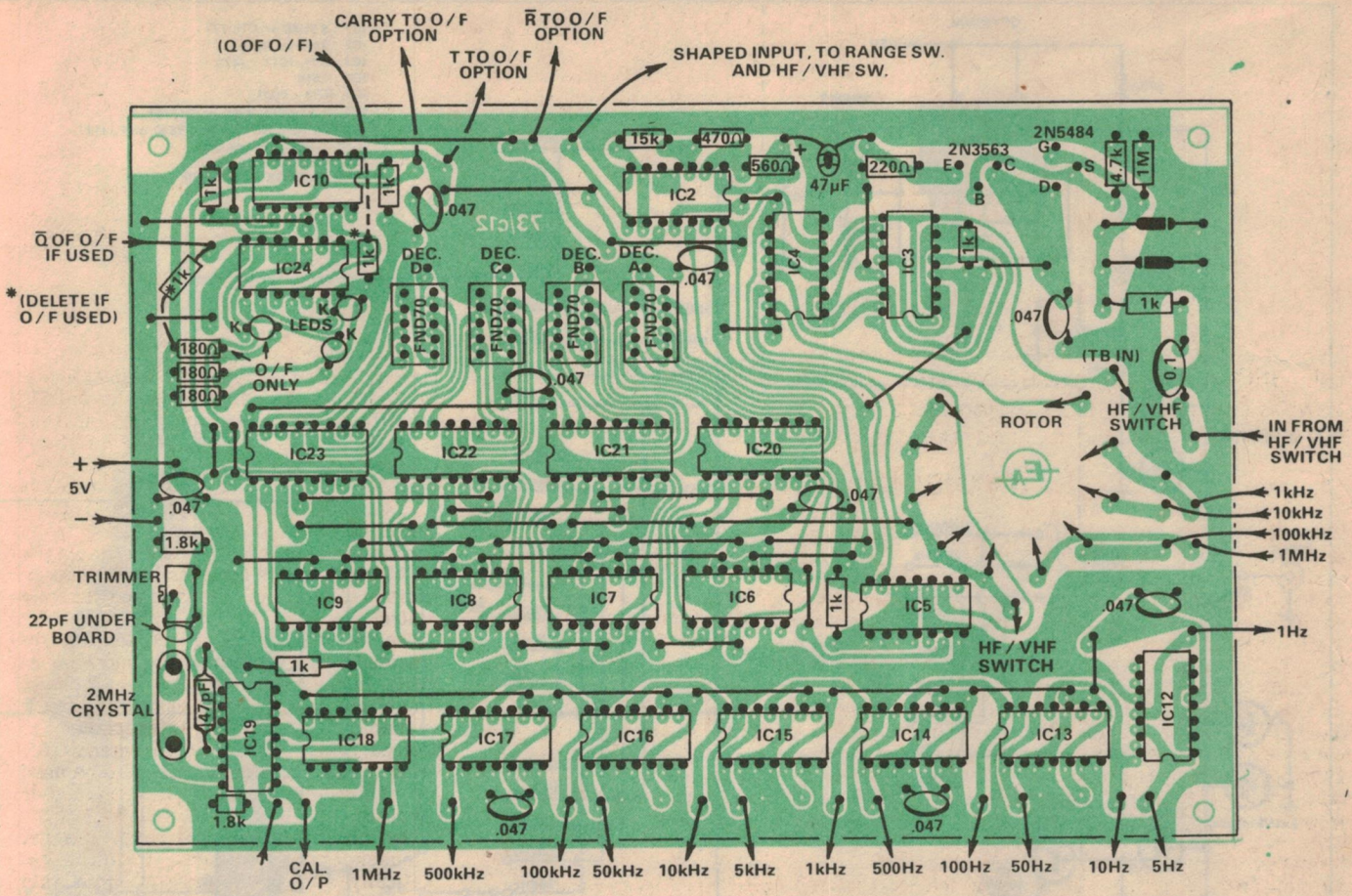
There is in fact only one main control: the range switch. This has nine positions, five for frequency measurement and four for period measurement. The frequency ranges have nominal full-scale readings of 20kHz, 200kHz, 2MHz, 20MHz and 200MHz respectively while the period ranges count in units of 1us, 10us, 100us and 1ms respectively.

The only other controls are the power switch and a switch to connect the internal prescaler into circuit when measuring signals above 20MHz, the latter being required only if the prescaler option is fitted.

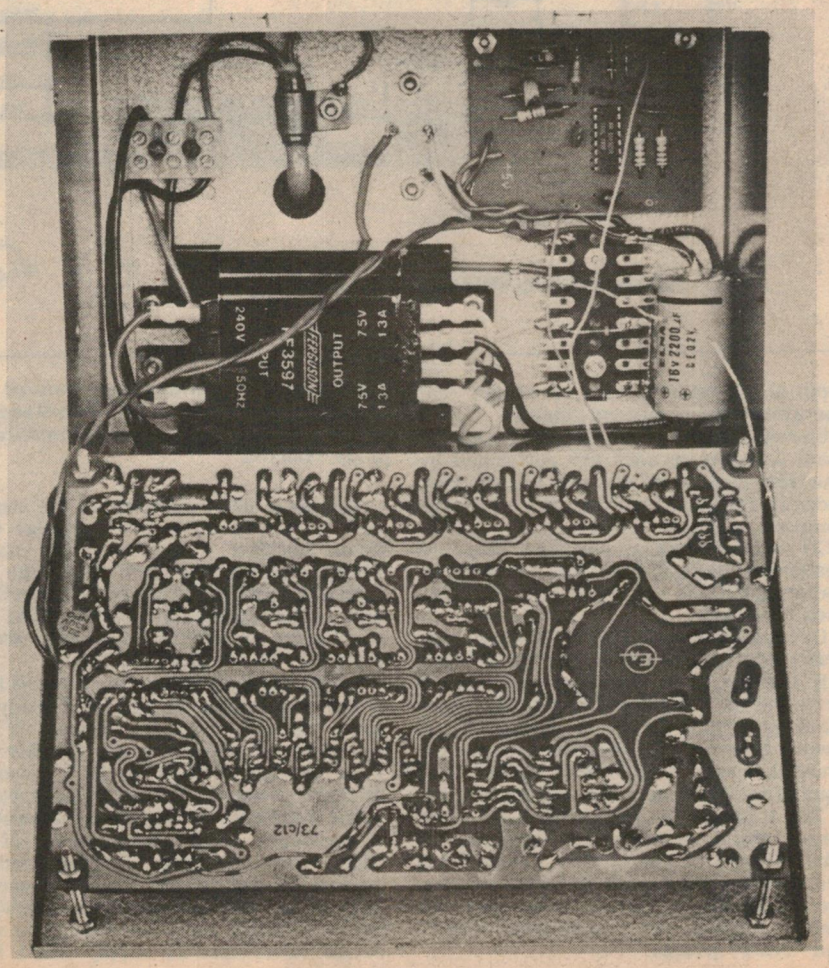
In operation, the counter is therefore simplicity itself. Virtually all that is



Designed as a "twin" for the author's DVOM described in the January and February issues, our new counter has 4½-decade readout and will measure frequency to beyond 200MHz.



Almost all of the counter wiring is on a single printed board, reproduced above in the wiring diagram slightly smaller than actual size. Below right is a view inside the case, showing the remaining wiring.



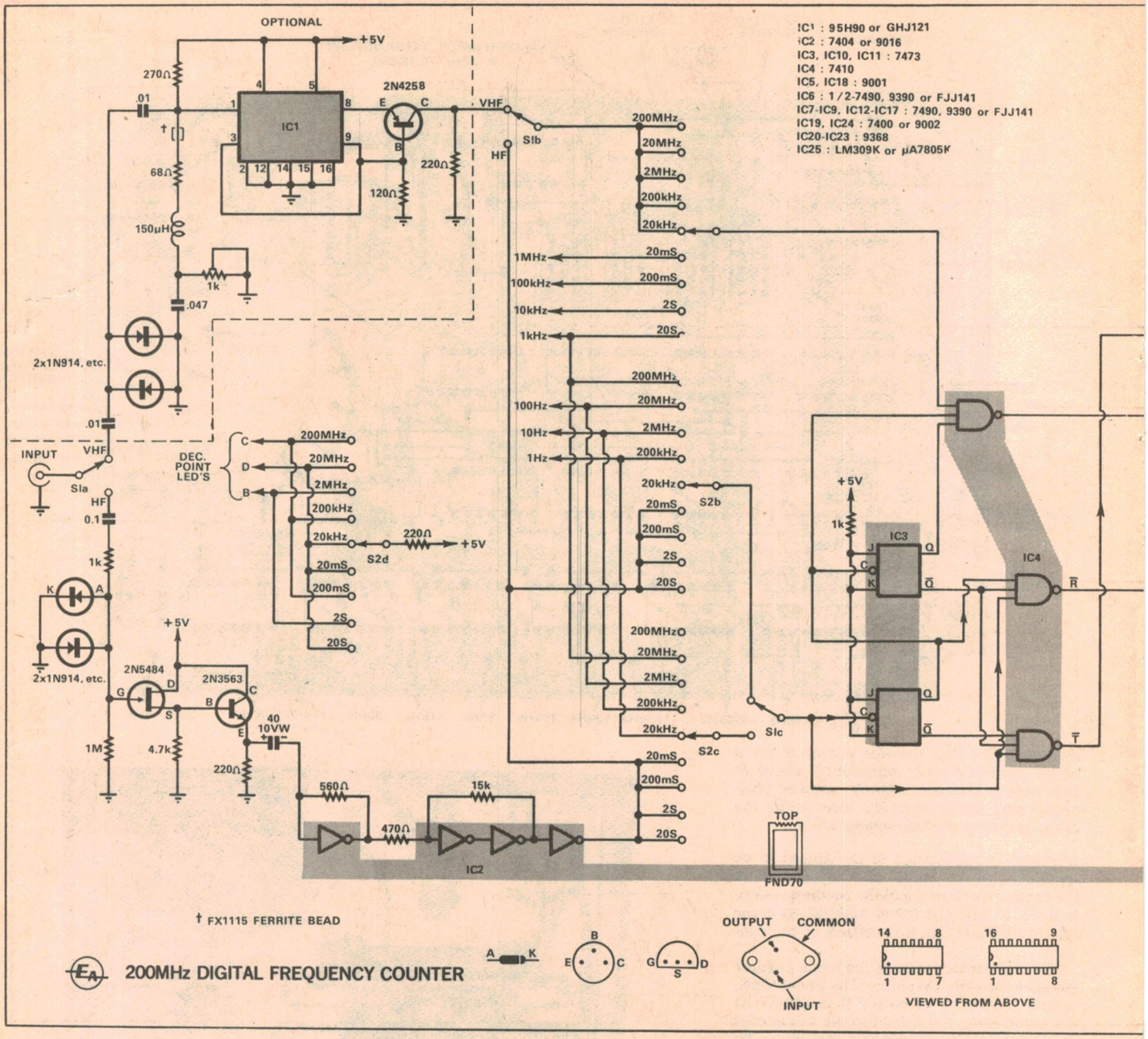
required is application of the signal to be measured to the input, and adjustment of the range switch to make the reading. There is little, if any, chance of making an error due to confusion or mis-setting of the controls.

The input impedance of the basic counter is approximately 1M shunted by about 50pF, with a sensitivity of better than 50mV. At the same time, the input circuit will accept at least 10V RMS without damage. When the 200MHz prescaler is in circuit, the input impedance falls to approximately 50 ohms, and the sensitivity to about 800mV. But these are still quite adequate for most VHF measurement purposes.

We estimate that the cost of the counter should be about $140, including the 200MHz prescaler. This seems very reasonable in view of the cost of the earlier designs, and the additional features we have been able to provide.

As may be seen from the circuit diagram, the new counter uses some 23 ICs, or only about half the number used in the previous designs. There are ten 7490 decade counter devices, six of which are used in the timebase divider chain and four in the counter itself. The crystal oscillator uses three of the four gates of a 7400 or similar, wired in the configuration recommended by Foster and Rankin in their article of November 1972.

A 9001 J-K flip-flop is used to derive the first timebase signal, 1MHz, from the 2MHz crystal frequency (the 2MHz crystal is used for economy). A second 9001 is used at the



200MHz DIGITAL FREQUENCY COUNTER

Considering the performance features offered by the counter, its circuit is surprisingly straightforward. All internal "housekeeping" is timed by a simple 2-bit counter and decoder system, so that the counter automatically adjusts its measurement rate according to the range selected.

input of the counter itself, to ensure that operation extends beyond 20MHz.

Storage and readout decoding for the main counting decades are performed by four 9368 devices. These are new devices, recently released by Fairchild, and each comprise a four-bit latch together with a BCD-to-seven-segment decoder. They are designed to work directly into the low-cost Fairchild FND-70 LED readouts, which are used here also.

Over-range counting and storage are performed by the two halves of a 7473 dual J-K flip-flop, with a further 7400 used to drive the LEDs and to generate the ripple blanking control signal. A second 7473 is used to generate the timing signals used for "housekeeping," being connected as a 2-bit counter fed by the selected timebase signal. A 7410 triple 3-input gate is used to decode the waveforms generated by this counter, to admit signals to the counter during what becomes the "count" phase, and to transfer the count to the latches and reset the counter during the subsequent "store" and "reset" phases.

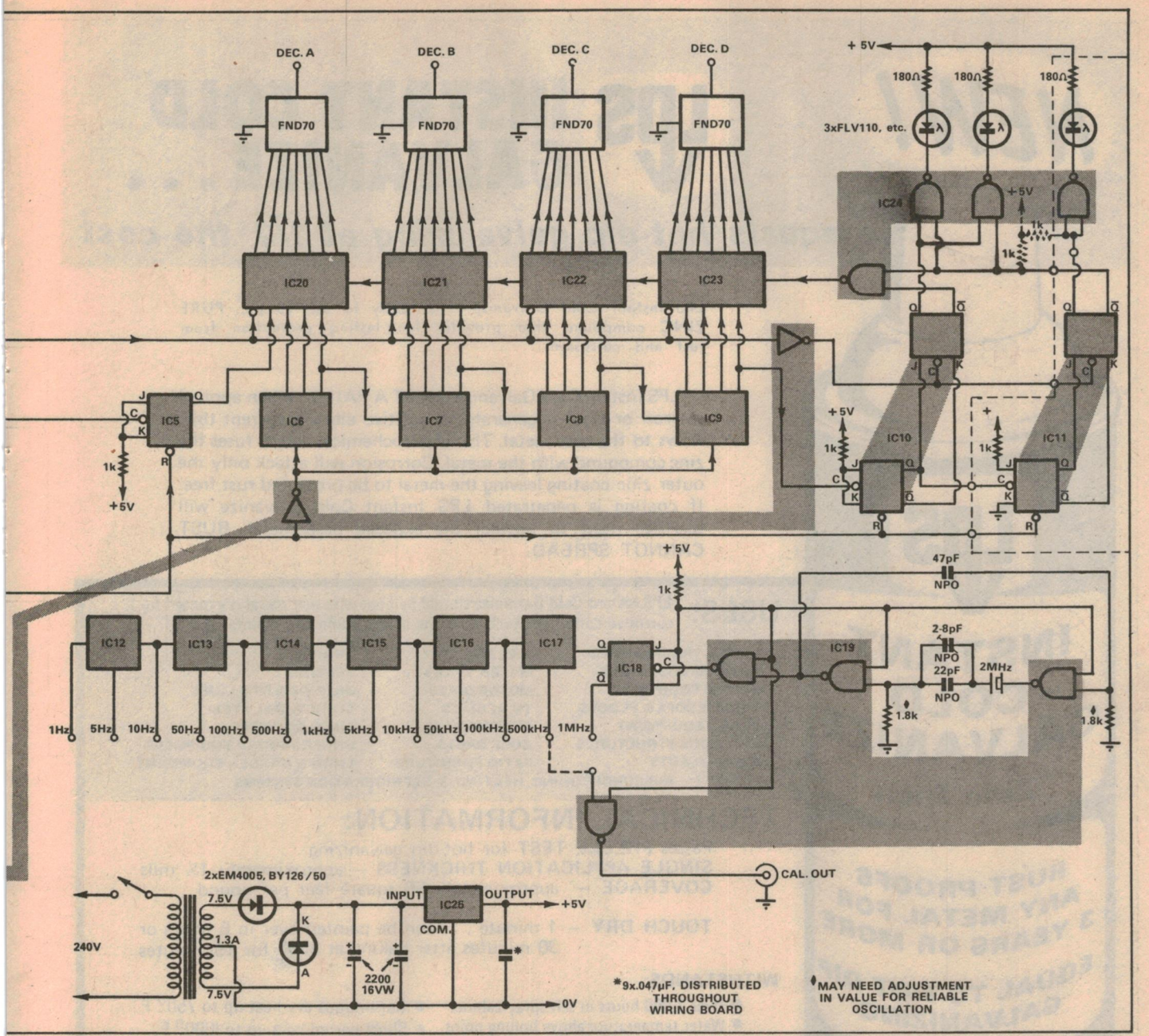
The main input circuitry of the counter uses a discrete FET and a bipolar transistor, together with four of the six inverters from a 7404 or similar. The configuration used is a well-known and reliable one, originally used by the US firm Hua Electronics, in their 2BC-1 counter (see the review in "QST", April 1972).

The 200MHz prescaler uses a 95H90 high-speed decade divider, and is basically the same as the "short" version of the prescaler I described in the October 1972 issue. As the 95H90 is an ECL device, a 2N4258 high-speed PNP transistor is used to perform logic level translation at its output.

The power supply requirement of the counter is quite modest. All of the functional circuits, including the readouts, operate from 5V DC. The drain will be somewhere between 850mA and 1.2A, depending upon device tolerances. To supply this I have used a three-terminal IC regulator of the TO-3 type (either the National LM309K or the Fairchild uA7805K), fed by a simple full wave rectifier circuit. The transformer used is the Ferguson type PF3597, a low-profile type with two 7.5V windings rated at 25VA maximum.

If it is desired to add the overflow option, this involves a further 7473 device together with an additional LED and series resistor. The main function of these is to ensure that the operator is always made aware of any overflow. A secondary function is to disable the leading zero blanking circuit, which can cause ambiguity with overflow counts. Neither of these functions is essential, so that the overflow option may be regarded as something of a "luxury."

With the exception of the power supply, all of the wiring and components of the basic 20MHz counter are mounted on a



single printed wiring board, which is fixed vertically behind the front panel of the case. This is the same simplified construction method used by the author in the DVOM described in the January and February 1973 issues, and in fact the new counter has been designed as a "twin" for that instrument.

The power transformer and other supply components are mounted on the inside rear of the case, towards the bottom. If used, the 200MHz prescaler is also mounted at the rear of the case, in the upper right-hand corner. Similarly the overflow option would be mounted at the upper left rear, if it is used.

Most of the wiring and construction of the counter should be clearly evident from the wiring diagrams and the photographs. There is only a relatively small amount of conventional wiring to be done, thanks to the printed board. The main thing to bear in mind is that the printed board pattern necessarily has small contact pads and thin conductors, so that the solder joints should be made carefully with a relatively low power iron to avoid damage. The most appropriate type of iron is a low wattage type having a very small chisel-shaped bit.

Note that provision has been made for supply bypass capacitors adjacent to each of the 7490 timebase dividers along the bottom of the board, but that capacitors are shown in only some of these positions. I found that these were quite sufficient to ensure reliable operation with the prototype, although one or two more could conceivably be required in some counters due to device variations.

Note also that provision has been made on the board for the connections to the overflow option, but that if the option is not used, some of the pads concerned are simply ignored while others are tied to the positive rail via protective resistors. Similarly the board has provision for mounting an overflow LED and its series resistor, but both are simply omitted if the overflow option is not used.

There are not many other points which need be mentioned. There is only one component on the board which is not specifically allowed for in the pattern, namely the 22pF NPO ceramic across the crystal oscillator trimmer. This mounts on the copper side. Make sure when mounting the FND-70 readout displays that their "grooved" ends are uppermost, as the reverse orientation will cause faulty operation. Also make sure that all of the ICs are correctly orientated, as indicated by the small rounded notches at one end. These should be in the positions shown in the board wiring diagram.

The connections for the rearmost section of the function switch are provided by the printed board pattern, while some of the connections for the other sections are provided nearby. The easiest scheme when assembling the counter is to wire up the printed board apart from the switch, then solder short lengths of tinned copper wire to the lugs at the rear of the switch, and use these to attach the switch to the board. The ten soldered joints will join the two sufficiently firmly to allow you to perform the remainder of the switch wiring easily.

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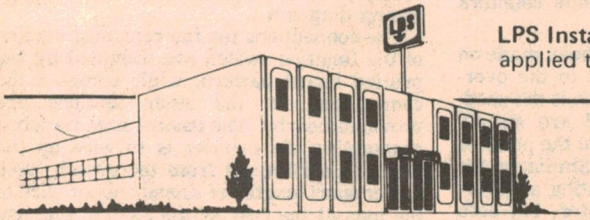

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the back of the case front panel not just by the function switch, but also by four 50mm-long screws (¼in Whitworth or 3mm metric), using nuts as spacers to adjust the corners of the board to match the spacing established by the switch. But before the board is attached to the panel, the two-co-axial connectors and the small toggle switches should be fitted to the latter, together with the etched escutcheon plate and the 45 x 100 mm piece of red or orange perspex used as a readout filter. This is cemented to the rear of the front panel, squarely behind the cutout window, using "Araldite" or similar epoxy adhesive.

You have a certain amount of latitude regarding the wiring for the "calibrate" output provided on the counter. As may be seen, the fourth gate of the 7400 used in the crystal oscillator is used as a buffer for this output, so that the calibrate output connector is permanently connected to the output of this gate. But the connection to the gate input is largely up to you, depending upon the use you intend to make of the calibrate facility.

If you are basically only going to use the calibrate output as a means of calibrating the counter itself, by comparing it with a reference such as the standard frequency station VNG at Lyndhurst, Victoria (4.5, 7.5 and 12MHz), then the best and easiest idea is to simply connect the gate input to an appropriate output of the timebase divider. This will normally be the 500kHz output, which is the highest frequency having harmonics at all three VNG signal frequencies.

On the other hand, if you want to take advantage of the various calibrating signals available inside the counter, for calibrating the dials of receivers, etc, a better approach would be to fit a small selector switch either on the front or at the rear of the case, so that any of a number of frequencies may be chosen at will. Thus a 5-position switch could be used to provide either 1MHz, 500kHz, 100kHz, 50kHz or 10kHz, a selection which would be very useful for calibration of receivers and similar equipment.

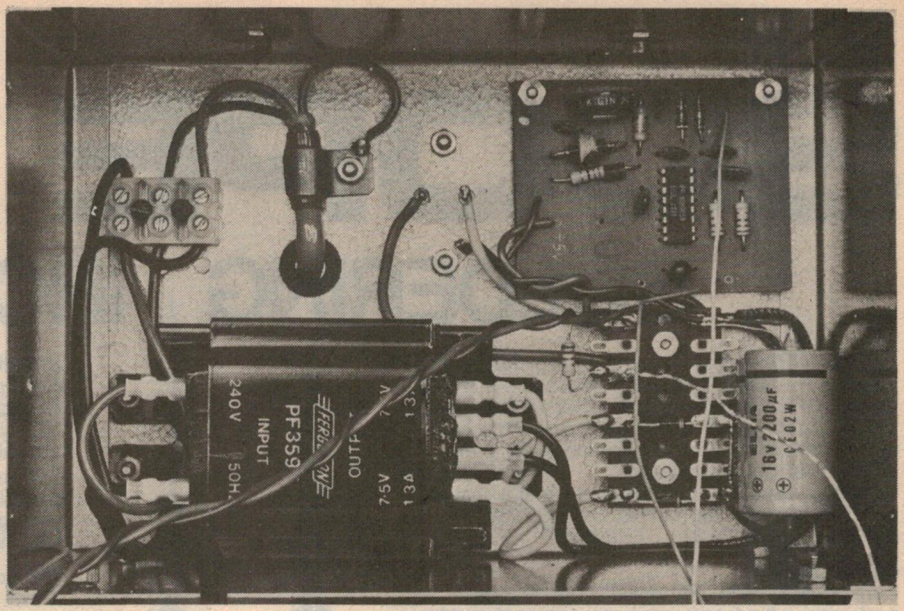
Before mounting the power supply regulator IC to the rear of the case, make sure that any bumps and lumps in the lacquer finish have been smoothed away using fine sandpaper. This is to ensure that there is a good thermal path from the IC to the metal case. It would be a good idea to apply a smear of silicone grease to both surfaces before the IC is mounted, for the same reason.

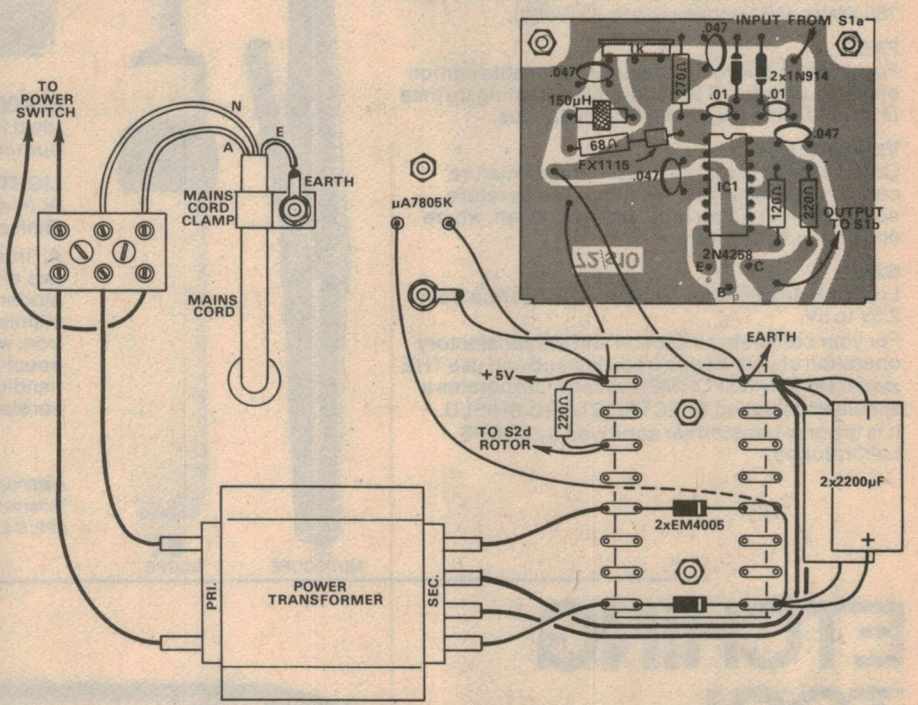
Note that to comply with power supply authority safety codes, the mains cord should enter the case via a grommetted hole, and should clamped firmly upon entry using a small metal clamp. The mains and neutral wires should be terminated in a small section of "B-B" strip, as shown, while the earth wire should be soldered to a lug screwed to the metal case.

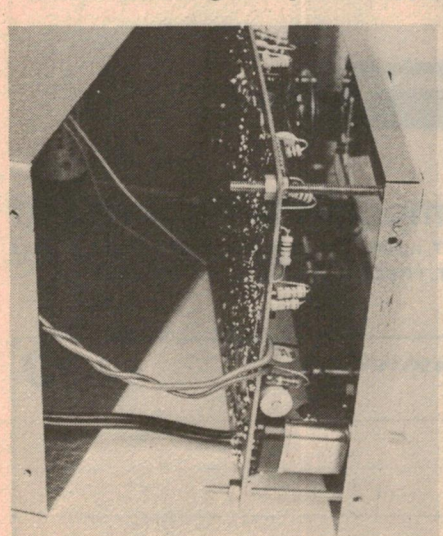
Don't forget to drill a hole about 5 mm in diameter in the left-hand end of the case, to allow fine adjustment of crystal oscillator frequency when the counter is fully assembled (for calibration). Similarly a hole of the same size should be provided at the right rear of the case top if the 200MHz prescaler is fitted, to allow adjustment for maximum prescaler sensitivity.

When the counter is complete, applying the power should bring it into immediate "life." It should be ready for making measurements, at least as far as the main 20MHz section is concerned. To check this, simply try measuring the 500kHz calibrate output signal on the 2MHz range. The readout displays should immediately register 500.0 or 500.1.

If this does not occur, the odds are that you have made a wiring error, so immediately switch off and start checking your wiring. There is not much to check, as







A view showing the left-hand end of the board and front panel, as swung out from the case. Note the crystal oscillator vernier trimmer.

At top is a close-up view of the inside rear of the case, to assist in duplicating the wiring shown above in the diagram. If the overflow option is used its additional 7473 device can easily be fitted in at top left.

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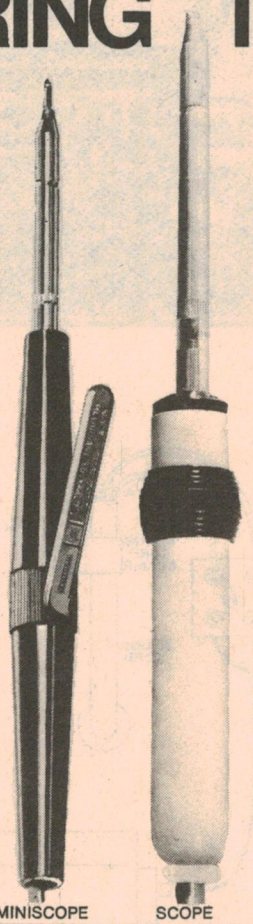

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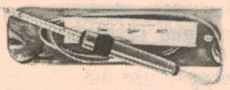

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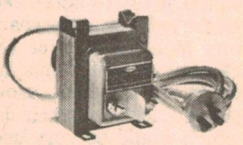

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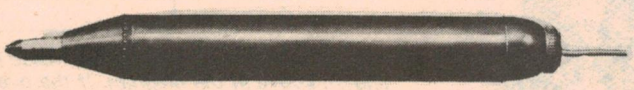

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200MHz counter

the board does most of the work, so that it should not be difficult to find a fault.

The only other likely cause of non-operation is a lack of oscillation in the crystal oscillator, due to within-tolerance component variations. It may be necessary to adjust the value of one or both of the biasing resistors shown as 1.8k, in order to achieve reliable oscillation.

There are only two adjustments to be made to prepare the counter for final use: adjustment of the prescaler sensitivity, and calibration. The former will of course only be required if the prescaler is used.

Basically, the idea of the sensitivity adjustment is to adjust the bias on the prescaler so that it operates correctly for the smallest possible input signal. The easiest way to do this is to feed a VHF signal into the counter (with the toggle switch set to the "greater than 20MHz" position), from a source such as a signal generator or a "sniffer loop" held near the output tank of a transmitter. Then simply adjust the bias preset pot until a stable reading can be obtained with the smallest input signal. There will be a limit to how far the input signal can be reduced, of course; with too small a signal, the reading on the counter will drop from its correct value and vary randomly.

Calibrating the counter is just as simple. Here the easiest way is to have a short-wave receiver tuned to one of the signals from a standards station such as VNG — say that on 7.5MHz. Then connect a short length of wire to the calibrate output of the counter, and lay the wire near the aerial lead to the receiver. A beat note should become audible in the receiver output, and the calibration is simply a matter of adjusting the trimmer in the counter for zero beat.

For the best result, the calibration should be carried out only after the counter has been on for an hour or so, to stabilise its temperature. If the receiver is fitted with an "S" meter, this can be used to get closer to the true zero beat condition than if the audio output is used alone. The idea is to try and get the needle of the meter swinging as slowly as possible. It may be necessary to adjust the coupling between the counter and the receiver aerial lead, in order to make the swing properly visible.

There you have it, then. A fully solid-state digital counter, very compact and easy to build, and at a cost significantly below that of earlier designs. If carefully assembled, it should prove a very worthwhile asset in any home workshop, amateur "shack" or small lab.

COMPLETE PARTS LIST FOR 200MHz COUNTER

BASIC 20MHz COUNTER

1 Case, 190 x 130 x 105mm with wrap-around front panel.
1 Power transformer, 240V to 7.5V and 7.5V at 1.3A. (Ferguson type PF3597 or similar.)
1 Printed wiring board, 73 / c12 (180 x 120mm)
1 Rotary switch, 2 sections 2 x 9 (MSP type FE–69003–131 or similar)
1 2MHz quartz crystal, AT-cut fundamental, .003pc tolerance, ambient temperature, calibrated for 30pF shunt C. (Hy-Q code PEE)
1 Miniature toggle switch, SPST
1 Miniature toggle switch, 3-pole double throw

SEMICONDUCTORS

10 7490, 9390 or similar decade counter
4 9368 latch decoder
2 7473 twin J-K flipflop
2 .9001 high-speed J-K flipflop
2 7400, 9002 or similar quad gate
1 7410 or similar triple gate
1 7404 or similar hex inverter
1 LM309K, uA 7805K or similar 5V regulator
4 FND-70 seven-segment LED readouts
2 FLV110 or similar LED
1 2N5484, FE5484 or similar FET
1 2N3563 or similar NPN silicon
2 1N914 or similar silicon diode
2 BY126 / 50, EM4005 or similar

RESISTORS

All half-watt 5pc tolerance.
2 x 180 ohms, 2 x 220 ohms, 1 x 470 ohms, 1 x 560 ohms, 6 x 1k, 2 x 1.8k, 1 x 4.7k, 1 x 15k, 1 x 1M

CAPACITORS

1 22pF NPO ceramic
1 47pF NPO ceramic
1 2-8pF NPO ceramic trimmer (Type DV11-PR8A from Plessey Professional Components).
1 0.1uF 100VW polyester
9 .047uF 25VW redcap ceramic
1 47uF 10VW miniature tantalum
2 2000uF 16VW pigtail electrolytic

MISCELLANEOUS

Mains cord and plug; handle and rubber feet for case; 45 x 100mm piece of orange or red perspex for filter; 4 x 50mm long screws to support wiring board (⅛in Whitworth or 3mm metric); 2 x co-axial connectors; knob for function switch; D-type crystal socket; 3-connector section of B-B strip: 8-lug-pair section of miniature resistor panel; mains cord clamp and entry grommet; tinned copper wire and hookup wire; screws, nuts, solder, etc.

ADDITIONAL PARTS FOR 200MHz PRESCALER

1 Printed board, part of 72 / s10 (54 x 70mm)
1 95H90 high speed decade divider
1 2N4258 high speed PNP silicon
2 1N914 or similar diodes
2 .01uF 25VW redcap ceramic
4 .047uF 25VW redcap ceramic
1 150uH peaking inductor
1 FX1115 or similar ferrite bead
1 68 ohm ½ watt resistor
1 120 ohm ½ watt resistor
1 220 ohm ½ watt resistor
1 270 ohm ½ watt resistor
1 1k lin miniature tab pot

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used in our prototype. Components with higher ratings may generally be used if physically compatible. Components with lower ratings may be used in some cases, if ratings are not exceeded.

For boating enthusiasts:

The Heathkit MI-1031 Deluxe Depth Sounder

For those readers who are also boating enthusiasts, this depth sounder kit from the Heath Company may be of interest. It provides for "continuous" depth measurements down to a depth of 240 feet, and is simple to construct and operate. By arrangement with the local Heath agents, we assembled a kit and tested it in a boat. This article reports our findings.

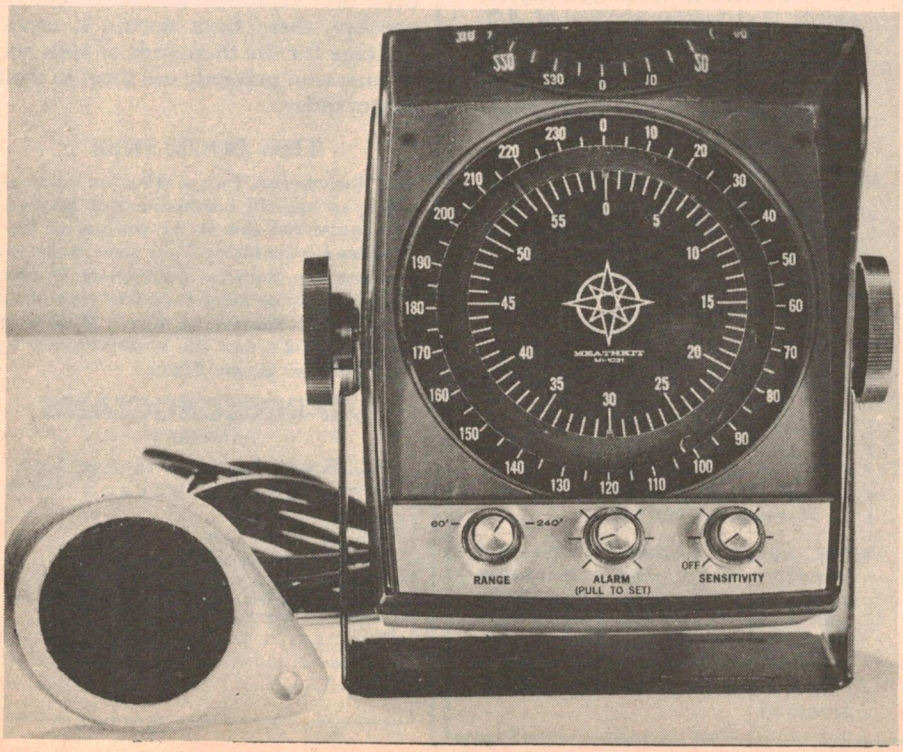
by GREG SWAIN and ROBERT FLYNN

A recent addition to the Heathkit line-up of electronic kitsets is the Model MI-1031 Deluxe Depth Sounder. This is a compact, solid state instrument capable of measuring water depths, or depths to submerged objects, down to 240 feet. In addition to its use as a navigational instrument, the depth sounder can also be used to locate schools of fish.

The kit comes complete with the usual comprehensive assembly-instruction manual which describes the construction of the unit in a step-by-step manner. In fact, their instruction manuals are so detailed that Heath claim even those with no previous experience in electronics can build their kitsets. All that is required is a knowledge of soldering techniques.

The depth sounder uses 26 transistors and 11 diodes, in a fully solid state circuit which has been designed to operate with a minimum power drain from any 12 volt DC source. A noise rejection circuit eliminates the ignition interference produced by most boat motors, enabling the depth sounder to be operated at maximum sensitivity.

One attractive feature of the Heathkit Model MI-1031 depth sounder is its audible alarm system. When selected, this alarm indicates underwater objects that occur above a preset depth, thus eliminating the need for continuous visual monitoring. Additional features include: a corrosion resistant cabinet, a sun-shielded dial, a straightforward control panel, and gimbal mounting. The gimbal mounting can be used to position the unit at any desirable viewing angle.



The completed depth sounder, together with its gimbal mounting and the transducer.

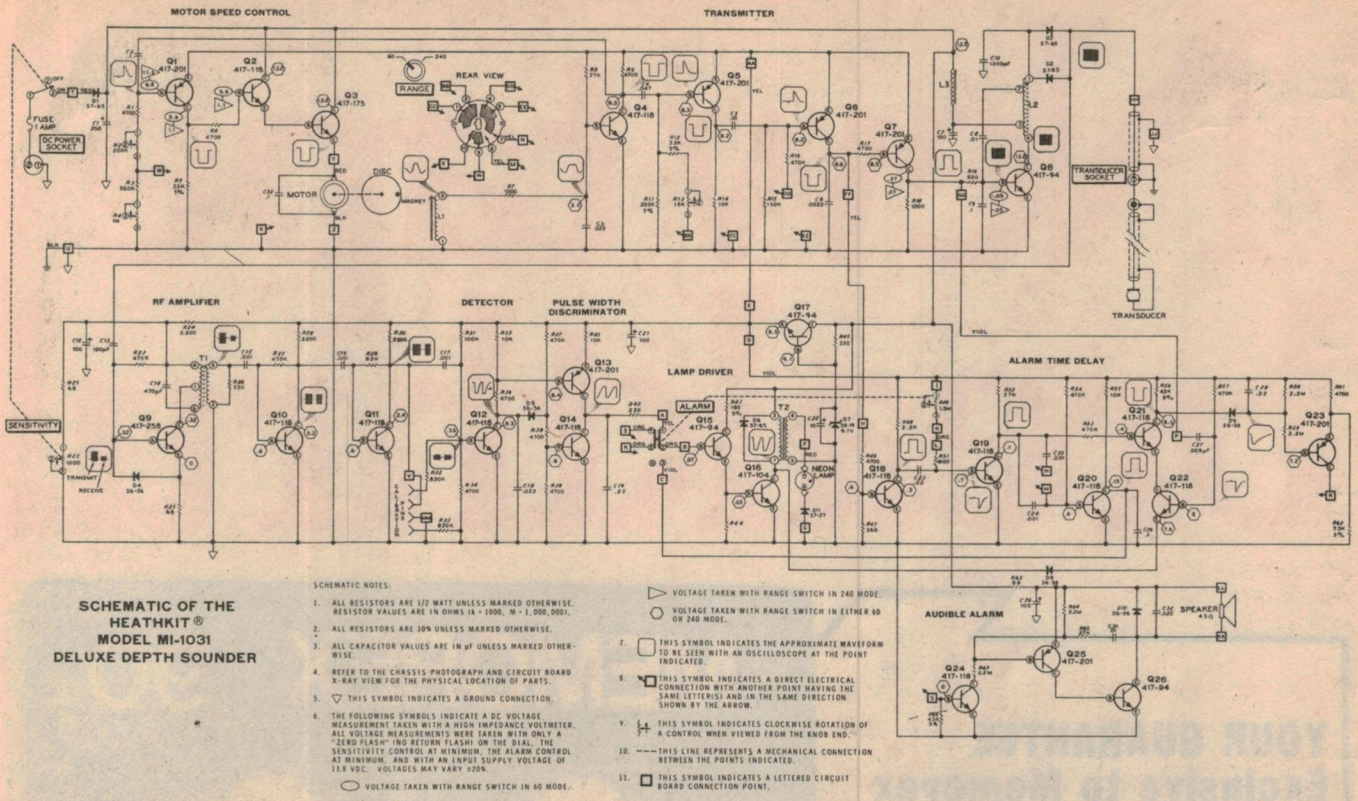
The theoretical aspects of the unit's operation may be considered at this stage. Basically, the circuit consists of a transducer, a rotating disc assembly, a motor, a transmitter circuit, a receiver circuit and an alarm circuit. Electrical pulses at 200kHz from the transmitter are applied to the transducer, which contains a piezoelectric ceramic element. This vibrates and directs a pulsed narrow beam signal towards the bottom of the harbour (or river channel). At the same time as the signal leaves the transducer, the neon lamp on the rotating disc is made to flash at the zero depth mark on the scale.

The time required for a signal to travel from the transducer to the harbour bottom is equal to the water depth divided by the speed of sound in water (approximately 4,800ft / sec; varies according to water temperature, salinity etc). For example, if we assume that the depth of water under the boat is 30ft, then the pulse travel time from the transducer to the bottom is equal to 30ft divided by 4,800ft / sec. This gives a result of 6.25 milliseconds. It then takes another 6.25ms for the reflected signal to travel back to the transducer, resulting in a total travel time of 12.5ms.

In practice, only a small amount of the energy of the transmitted pulse is reflected back to the transducer. This is due to the fact that seabed irregularities give rise to signal scattering effects. Unconsolidated sediments such as mud and sand may also absorb a significant part of the transmitted pulse.

Upon reaching the transducer, the reflected signal causes the ceramic element to vibrate at the same frequency as the pulse that was originally transmitted. This vibration causes the element to generate a pulsed 200kHz signal which is then amplified and applied to the neon lamp. Transformer T1 and capacitor C14 combine to act as a bandpass filter circuit that responds only to those frequencies near 200kHz. Signals of other frequencies, including noise, are filtered out by this circuit.

When the range switch is placed in the 60ft mode, the nylon disc assembly, on which the neon lamp is mounted, is caused to rotate at a speed of 2,400rpm. This speed represents a time of 25 milliseconds for each revolution. Therefore, in the example given, the disc would have rotated ½ of one revolution during the signal travel time of 12.5ms. This causes the neon lamp to flash at the bottom of the calibrated dial scale, or at the 30ft

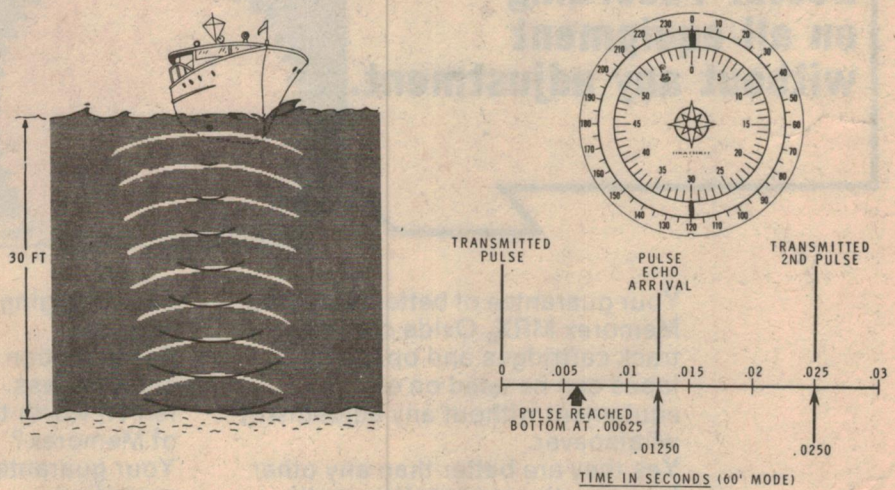


SCHEMATIC OF THE HEATHKIT® MODEL MI-1031 DELUXE DEPTH SOUNDER

SCHEMATIC NOTES:

1. ALL RESISTORS ARE 1/2 WATT UNLESS MARKED OTHERWISE. RESISTOR VALUES ARE 1% OHMS (R - 1000, M - 1,000,000).
2. ALL RESISTORS ARE 10% UNLESS MARKED OTHERWISE.
3. ALL CAPACITOR VALUES ARE IN µF UNLESS MARKED OTHERWISE.
4. REFER TO THE CHASSIS PHOTOGRAPH AND CIRCUIT BOARD X-RAY VIEW FOR THE PHYSICAL LOCATION OF PARTS.
5. ▽ THIS SYMBOL INDICATES A GROUND CONNECTION.
6. THE FOLLOWING SYMBOLS INDICATE A DC VOLTAGE MEASUREMENT TAKEN WITH A HIGH IMPEDANCE VOLTMETER. ALL VOLTAGE MEASUREMENTS WERE TAKEN WITH ONLY A "ZERO FLASH" (NO RETURN FLASH) ON THE DIAL, THE SENSITIVITY CONTROL AT MINIMUM, THE ALARM CONTROL AT MINIMUM, AND WITH AN INPUT SUPPLY VOLTAGE OF 13.8 VDC. VOLTAGES MAY VARY ±20%.
- ⬭ VOLTAGE TAKEN WITH RANGE SWITCH IN 60 MODE.
- ▷ VOLTAGE TAKEN WITH RANGE SWITCH IN 240 MODE.
- ⬡ VOLTAGE TAKEN WITH RANGE SWITCH IN EITHER 60 OR 240 MODE.
7. ▢ THIS SYMBOL INDICATES THE APPROXIMATE WAVEFORM TO BE SEEN WITH AN OSCILLOSCOPE AT THE POINT INDICATED.
8. THIS SYMBOL INDICATES A DIRECT ELECTRICAL CONNECTION WITH ANOTHER POINT HAVING THE SAME LETTER(S) AND IN THE SAME DIRECTION SHOWN BY THE ARROW.
9. THIS SYMBOL INDICATES CLOCKWISE ROTATION OF A CONTROL WHEN VIEWED FROM THE KNOB END.
10. THIS LINE REPRESENTS A MECHANICAL CONNECTION BETWEEN THE POINTS INDICATED.
11. ▢ THIS SYMBOL INDICATES A LETTERED CIRCUIT BOARD CONNECTION POINT.

Above is the circuit diagram of the Heathkit Model MI-1031 Deluxe Depth Sounder as published in the Heathkit assembly manual. The diagram below illustrates the time / depth relationships involved in the unit's operation.



mark on the inner scale.

When the range switch is placed in the 240ft mode, the nylon disc rotates at a speed of 600rpm, representing a time of 100 milliseconds for each revolution. During a signal travel time of 12.5ms (as in the above example), the disc would have rotated only ⅛ of one revolution. This causes the neon lamp to flash at the 30ft mark on the outer scale.

Since the transmit-receive cycle is repeated 40 times per second in the 60ft mode, and 10 times per second in the 240 foot mode, the overall effect is that of a continuous sounding. Therefore, even relatively small variations of the bottom contour can be observed whilst the boat is in motion.

One aspect of the Heathkit MI-1031 depth sounder that is worth examining in some detail is the rotating nylon disc assembly. The neon lamp is mounted in a small clip on the front side of the disc, and its leads are passed through two small holes drilled side by side near the centre of the disc. The lamp is electrically connected to the rest of the circuit by a brush fed slip ring arrangement. A permanent magnet is mounted at the other end of the disc, on the reverse side. The disc is then simply fitted to the motor shaft.

The nylon disc is rotated at a controlled speed by the motor. For each revolution of the disc, the permanent magnet mounted on its face is caused to pass over the pickup coil L1 and induce a voltage pulse across the coil. This voltage pulse is applied through resistor R7 to the base of transistor Q4 and causes Q4 to conduct and produce a negative pulse at its collector. The negative pulse is then differentiated by capacitor C4 and resistor R11 (plus resistor R12 when in the 240 mode) and applied to transistor Q5. This causes Q5 to turn off and produce a negative pulse at its collector. Q5 and its associated components are the delay circuit used to match the zero flash on the dial with the zero marks on the depth label.

The negative pulse taken from the collector of transistor Q5 is differentiated by capacitor C5 and resistor R15 (plus resistor R16 when in the 240 mode) and applied to transistor Q6. This causes Q6 to turn off and produce a negative pulse at its collector. Transistor Q6 and its associated components function much like transistor Q5. In this case however, the circuit is used to determine the time duration of the transmitted pulse.

The negative pulse taken from the collector of transistor Q6 is then applied to the base of transistor Q7 which causes Q7 to conduct and produce a positive pulse at its collector. This positive pulse is applied to the base of transistor Q8 which, because of the tuned circuit comprised of coil L2, capacitor C10, and the transducer, oscillates at a frequency of approximately 200kHz for the duration of the pulse.

The 200kHz signal is increased in amplitude to approximately 200 volts peak-to-peak by coil L2, and is then applied to the transducer. Diodes D1 and D2 serve to decouple any strong "ringing" of oscillations that might otherwise result within coil L2. The transducer converts the electrical signal to an ultrasonic signal that is coupled into the water.

All of the circuit operations described in the preceding paragraphs occur only when the magnet induces voltage into the pickup coil. Therefore, the transducer can produce an ultrasonic signal only at this time. This leaves the transducer free to receive signals that are reflected back from the bottom during the time remaining for each disc revolution.

The negative pulse produced at the collector of transistor Q4, as described previously, is also applied to the motor

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speed control circuits. Here, the negative pulse is differentiated by capacitor C2, resistors R1 and R2 (plus R3 and R4 when operating in the 240 mode), and applied to the base of transistor Q1. Transistor Q1 is momentarily turned off to produce a negative pulse at its collector. The negative pulse taken from the collector of transistor Q1 is then applied to the base of transistor Q2 and Q3 for a short period of time. When Q3 is turned off, no power is applied to the motor.

As before, these circuit operations occur only when the magnet induces voltage into the pickup coil, so that the motor is turned off for a fixed period of time during each disc revolution. This negative feedback action results in stabilisation of the motor's speed.

Construction of the unit is quite straightforward and, provided the instruction manual is carefully followed, no wiring difficulties should be encountered. All components, excepting the power cable socket, the transducer input socket, the power fuse, the speaker, the transducer, and the nylon disc assembly and its associated components are mounted on a 15 x 12½cm printed circuit board. To minimise the chances of a wiring error being made, the printed circuit board has been coded.

The fuse holder, the power supply socket, and the transducer input socket are all mounted on a U-shaped aluminium bracket which is bolted to one end of the printed circuit board. A second similar U-shaped bracket is bolted to the other end of the board to facilitate mounting the unit into its plastic case. The speaker is mounted on the back of the plastic case.

Detailed alignment instructions are presented in the instruction manual so that the depth sounder may be adjusted for optimum results. In particular, the "in water tuning" procedure should be carefully carried out to ensure that the unit operates at its maximum sensitivity. Most of these adjustment procedures are quite straightforward in nature, and are performed with the special alignment tool supplied with the kit.

However, the motor speed adjustment procedure normally requires that a 120 volt 60Hz source be applied to the two 820k resistors (R32 and R33) in the detector circuit. We were able to overcome this problem by applying a 60Hz signal from an AF signal generator direct to the base of transistor Q12. Note that the collector of transistor Q11 should be grounded during this procedure.

An alternate method is to perform the motor speed adjustments at a location where the water depth is accurately known. The motor speed is simply varied (by varying R2 and R4) until the correct depth value is displayed on the dial. Full details of this procedure are given in the instruction manual.

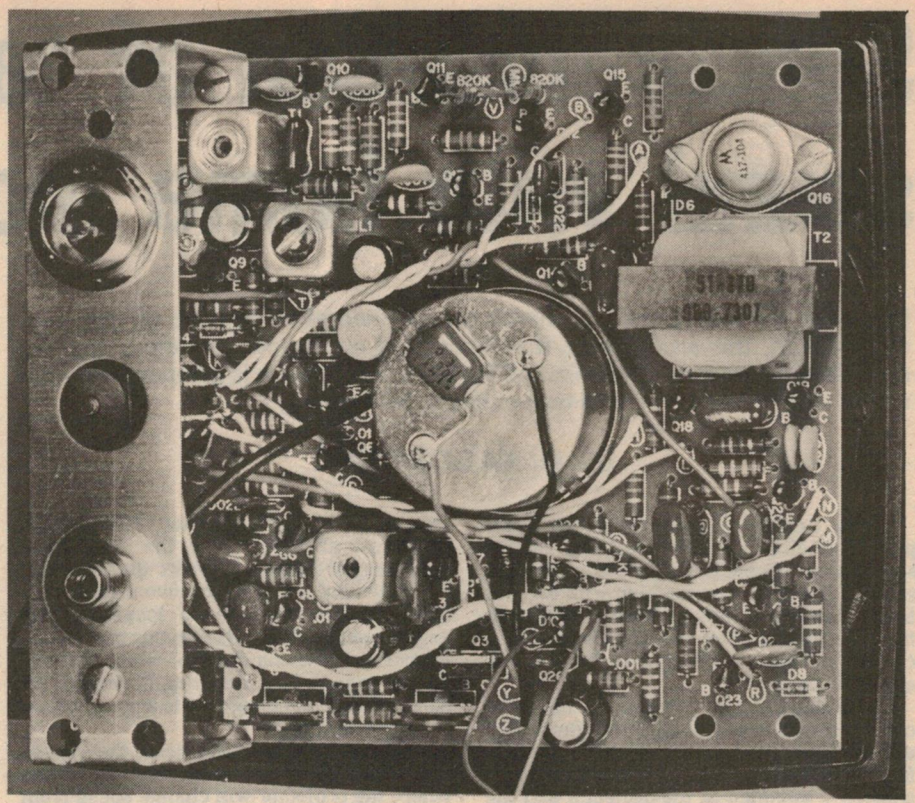
One point of criticism we would make about the unit is that the threaded connector nut on the DC power cable is limited in its travel by the control nut on the power cable socket. The result is that the socket connection is loose. However, this is only a minor criticism, and individual constructors should have no difficulty in overcoming this problem. We did so by removing two packing washers.

When we tested our assembled sounder under operational conditions at Pittwater, both ranges on the MI-1031 depth sounder returned consistently accurate results. The unit was first of all tested at a locality where the water depth was accurately known beforehand, and for subsequent readings was checked against a second depth sounder of known accuracy. The noise rejection circuit used in the unit proved to be extremely reliable under operational conditions, with no ignition interference evident from the six cylinder engine used to power the boat. However, should individual constructors encounter ignition interference problems, the assembly manual contains full details of an ignition interference suppressor circuit.

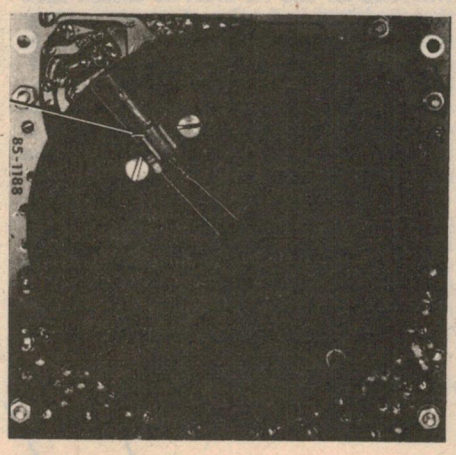
The audible alarm system also proved to be reliable under operational conditions, and emitted a loud warning buzz whenever the water depth was less than the preset level of the alarm.

Overall, our impression of the Heathkit Deluxe Depth Sounder is very favourable. It is a simple unit both to construct and to operate, and yet is capable of providing the boating enthusiast with consistently accurate water depth indications.

Those readers who are interested in obtaining a kitset for the MI—1031 Deluxe Depth Sounder should contact Schlumberger Instrumentation Australia Pty Ltd, PO Box 138 Kew, Victoria 3101. Telephone 86—9535. Also at Suite 7, P & M Building, 134 Willoughby Rd, Crows Nest. and in Brisbane, Perth and Adelaide.



The simplicity and compact nature of the unit is illustrated by the above photograph. Note the central location of the DC motor.



The above photograph shows the nylon disc assembly fitted to the motor shaft. Note the respective positions of the neon lamp and the magnet mounting bolt.

SPECIFICATIONS

Range: 0 to 60 feet on hard bottom and 0 to 240 feet on hard bottom.
Accuracy: plus or minus 2 percent for both range control settings.
Sounding rate: 40 times per second on the 0—60 foot range; 10 times per second on 0—240 foot range.
Frequency: 200kHz.
Transducer output: 150V peak-to-peak minimum.
Pulse width: 0.8 milliseconds on the 0—60 foot range; 1.4 milliseconds on the 0—240 foot range.
Receiver sensitivity: 75uV nominal at 200kHz. Transducer: barium titanate ceramic element encased in a watertight housing. Power requirements: 13.8 DC nominal (11—15V DC) at 225mA when using the 0—60 foot mode, or 125mA when using the 240 foot mode. Dimensions (less gimbal mounting bracket): 5¾" wide x 6½" high x 7¼" deep.
Net weight: 2¾ lbs.

Synchronisation of taped sound with home movies

Following our discussion last month on the theoretical aspects of tape synchronisation, this article gives theoretical and constructional details for two non-discriminating control units. All the basic information is given to allow the reader to build the unit that is best suited to his needs.

by N. LABORDUS *

In Fig 1 of last month's issue, the basic principles of a non-discriminating control system were given. If the projector speed is set at a level which is too high with respect to the tape speed, this controller will bring the average speed of the projector to the correct level by switching a resistor in and out of the circuit.

A simple practical version of this principle is shown in Fig 6. Both the film speed and the tape speed are converted into pulse frequencies by means of microswitches which are mounted on the projector and the tape recorder. The contacts of both switches are connected in parallel with resistor R2, which is connected in series with the projector motor. By selecting the correct value for resistors R1 and R2, the projector will operate at a speed whereby the on / off switching frequency of the projector switch is equal to the on / off switching frequency of the tape switch.

Full synchronisation between the tape speed and the film speed will be obtained when there is a 180 degree phase shift between the on / off switching cycles of the two microswitches. Therefore, during full synchronisation, resistor R2 will be short circuited. If, however, the on / off switching frequency of the projector microswitch becomes greater than the switching frequency of the tape recorder microswitch, the switching cycle of the two switch contacts, Sp and St, will no longer be 180 degrees out of phase. During this time, then, the current path via the two switch contacts will be open circuit, resulting in resistor R2 slowing down the projector to a speed below the noninal speed.

Under operational conditions, the system will tend towards an equilibrium condition where the projector will change speed from "too fast" to "too slow" in a rhythm determined by the difference of the impulses from the two microswitches. Resistors R1 and R2 must be chosen such that the integrated value of the momentary speed deviations with respect to time is zero. The introduction of two extra switches, S+ and S— (Fig 6), enables manual corrections to be made should loss of synchronisation occur. The small neon lamp is included to give a visual indication of the switching rhythm.

The physical construction of the non-discriminating control unit is shown in Fig 7. Basically, the system consists of two units which are identical in construction except for the rollers. Both units consist of a roller driven shaft on which a disc is mounted. Two of four quadrants on the disc are raised platform areas (shaded) which serve to turn the microswitch on by closing its contacts. In order to prevent tape or film slip, the friction of the microswitch units on the discs should be kept to a minimum.

The size of the roller for the tape unit must be chosen such that, at full synchronisation, the speed of the tape disc is the same as the speed of the disc in the projector unit. Given a nominal film speed of 16 frames per second, a tape speed of 9.5cm / sec, and a sprocket roller with Z pins, the diameter (D) of the tape roller may be calculated according to the following equation:

Eqn. (1) . . . . $D = 1.89Z$ (mm)

This equation was derived from the more general equation:

Eqn. (2) . . . . $D = (xZ) / (y\pi)$

where x is the tape speed, Z is the number of pins on the sprocket roller, and y is the film speed in frames per second. In most cases, the sprocket roller has twelve pins. Substitution of this value into Eqn (1) results in a value of 22.7mm for the diameter of the tape roller.

Mounting the projector control unit will necessitate some minor modifications to the projector itself. One of the leads to the motor must be cut and the two ends connected to a plug which is accessible from outside the projector. (Note: the plug terminals must be short circuited if the projector is to be used without the synchronisation unit.) The two manual correction switches, together with resistor R2 and the neon lamp, are mounted in the projector control unit.

* 1 Priestly Close, St Ives, NSW 2075.

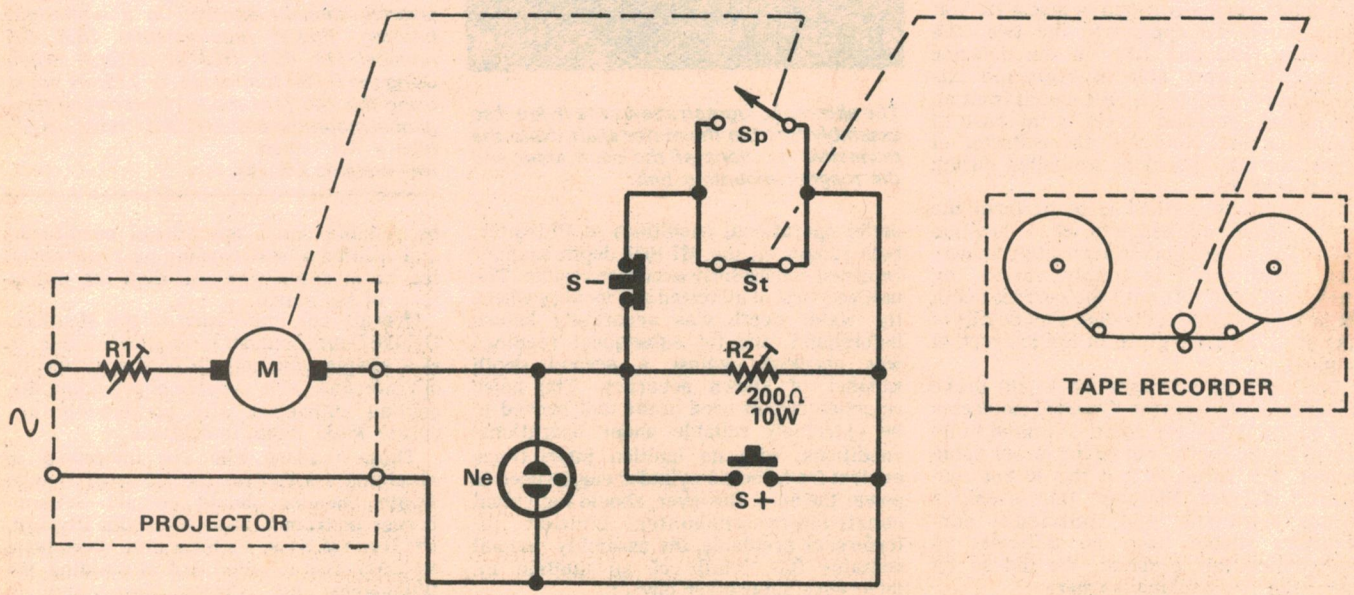


Fig 6: A simple practical version of a non-discriminating control unit.

The film soundtrack is produced by simply connecting the synchronising units to the projector and to the tape recorder, and recording the text on tape whilst the film is running. It is important to allow the film projector to reach its normal operational temperature before this is done, otherwise it may run slower than the minimum speed needed for this system to function correctly. Both the tape and film must be provided with a mark to indicate the starting point.

A major disadvantage of the above system is one that holds true for any system that uses the tape length as a sync reference. If a new tape is used to record the sound track, it is possible that, after further use, the tape will stretch. Under operational conditions, this results in the soundtrack falling progressively further and further behind the picture. The same effect will also be apparent if, for some reason, tape slip occurs in the microswitch unit.

In order to overcome these disadvantages, the following methods may be adopted: (a) modification of the tape switch unit to a version with considerably lower or no chance of slip, or (b) use of the tape contents as a sync reference, instead of the tape length.

Another possibility is to use perforated recording tape. This allows the tape unit to be fitted with a sprocket roller identical to the one used on the projector unit. Since sync now depends on the number of perforations, and this remains constant, tape stretch will have no influence. Also, fairly obviously, problems of tape slip are automatically eliminated.

The snag, in practice, is that perforated tape does not appear to be available in Australia. It is marketed in Britain and on the Continent in the BASF brand, but the Sydney agents for BASF (Maurice Chapman & Co Pty Ltd) advise that they do not stock it. The main problem appears to be one of limited demand, against the need to import a substantial quantity if the transaction is to be economic.

Where plain tape is concerned, slip may be minimised by increasing the friction between the tape and the tape roller (eg, by using a rubber presser roller against the metal one) and, at the same time, reducing the friction in the unit by exchanging the microswitch for a photoelectric device or an inductive device. These latter two devices are capable of providing sync signals without mechanical contact with the disc.

A practical approach to method (b) is to register synchronisation pulses in the form of audio signals on the tape. Although theoretically one would imagine that synchronisation signals at frequencies above 25kHz could be superimposed on the soundtrack, conventional tape recorders will not allow this due to their limited frequency response. Therefore, to use this principle, a stereo tape recorder is required so that one track can be used for film sound and the other for synchronisation signals. If a mono tape recorder only is available, it will be necessary to install another set of heads, together with associated electronics, to obtain a second track. As the quality of synchronisation is not influenced by the quality of the recording, the heads and electronics for this second track can be kept simple.

A complete diagram of a tape contents synchroniser is given in Fig 8. As was the case with the unit presented in Fig 6, this unit is a non-discriminating control system.

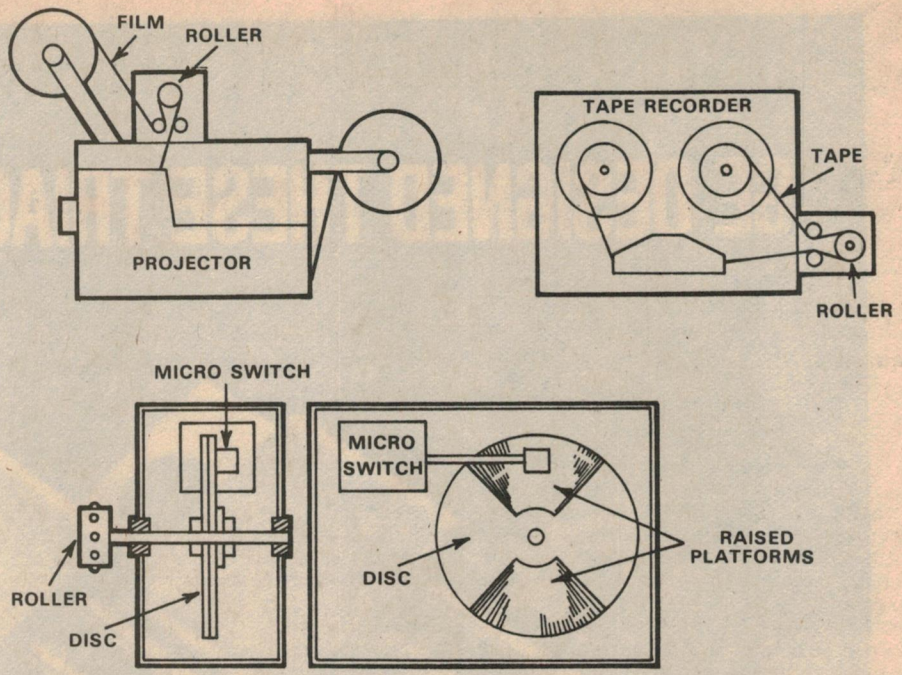
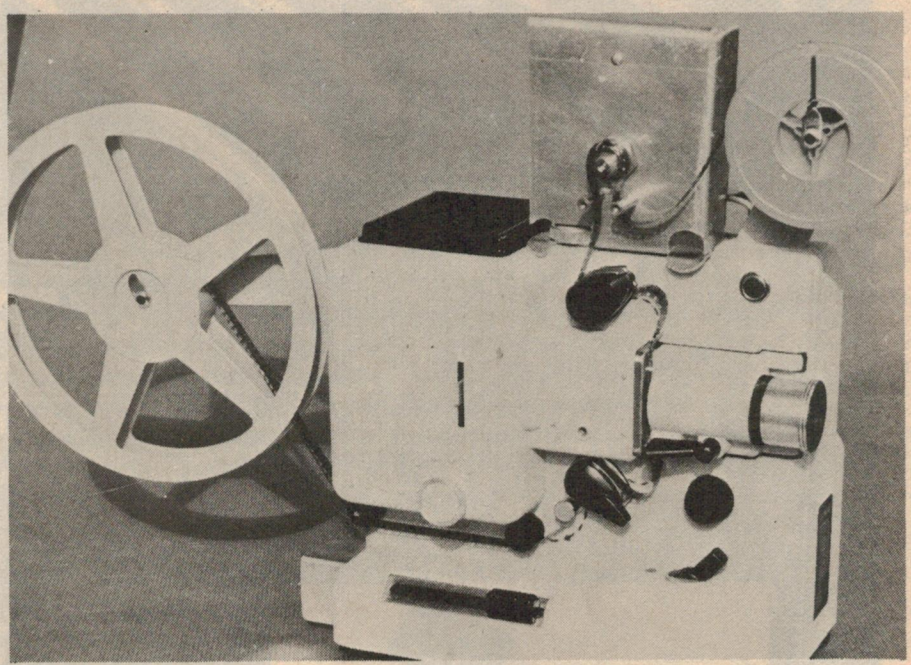


Fig 7 (above) shows the physical construction and placement of the microswitch units. Below is one of the microswitch units mounted on the author's projector.



However, instead of two microswitch contacts alternately bridging the motor series resistor, the new unit uses a relay that switches rhythmically at a speed determined by the difference of two input signals.

The relay Ry1 is activated by a projector operated switch, either as shown in Fig 7 or incorporated into the projector by using the shutter operating shaft which is accessible on most projectors. Two small magnets are cemented (with Araldite) to this shaft and these activate a reed switch.

The relay Ry1 is also activated by tape sync pulses which are amplified by TR1 and, after rectification fed to a DC amplifier (TR2 and TR3). During full synchronisation, Ry1 will remain activated at all times. In practice, the projector is set to run too fast. This causes the relay to cut out, thereby inserting a resistor into the motor circuit for short intervals, via contact Ry1b.

Sync pulses are recorded on the tape by simply switching the unit (and the tape recorder) to the record position and starting the projector. The synchronisation pulses are derived from TR4 which oscillates at approximately 4kHz. This signal is short circuited by relay contacts Ry1a until the projector is started. Starting the projector causes the relay to switch on and off, thus allowing synchronisation pulses to pass to the input of the tape recorder.

As before, it is important that the projector be allowed to reach its normal operating temperature and speed before recording the sync pulses.

The accompanying text and/or music can be recorded on the second track simultaneously with the synchronisation pulses. If this is not practicable, it is possible to put a low level cueing text on the

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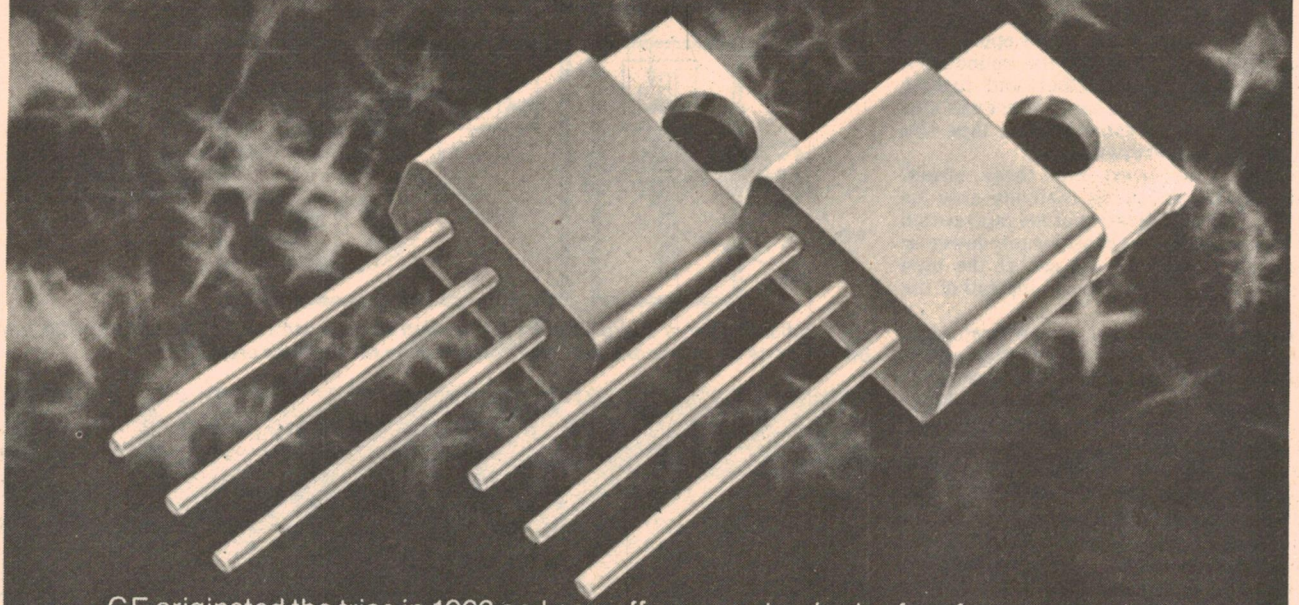

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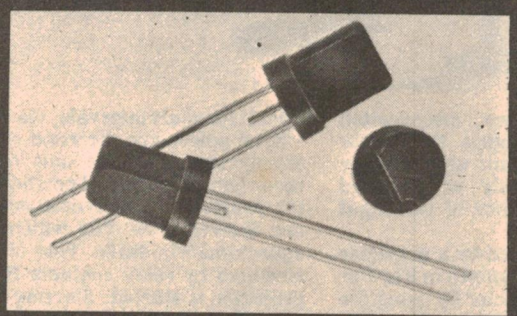

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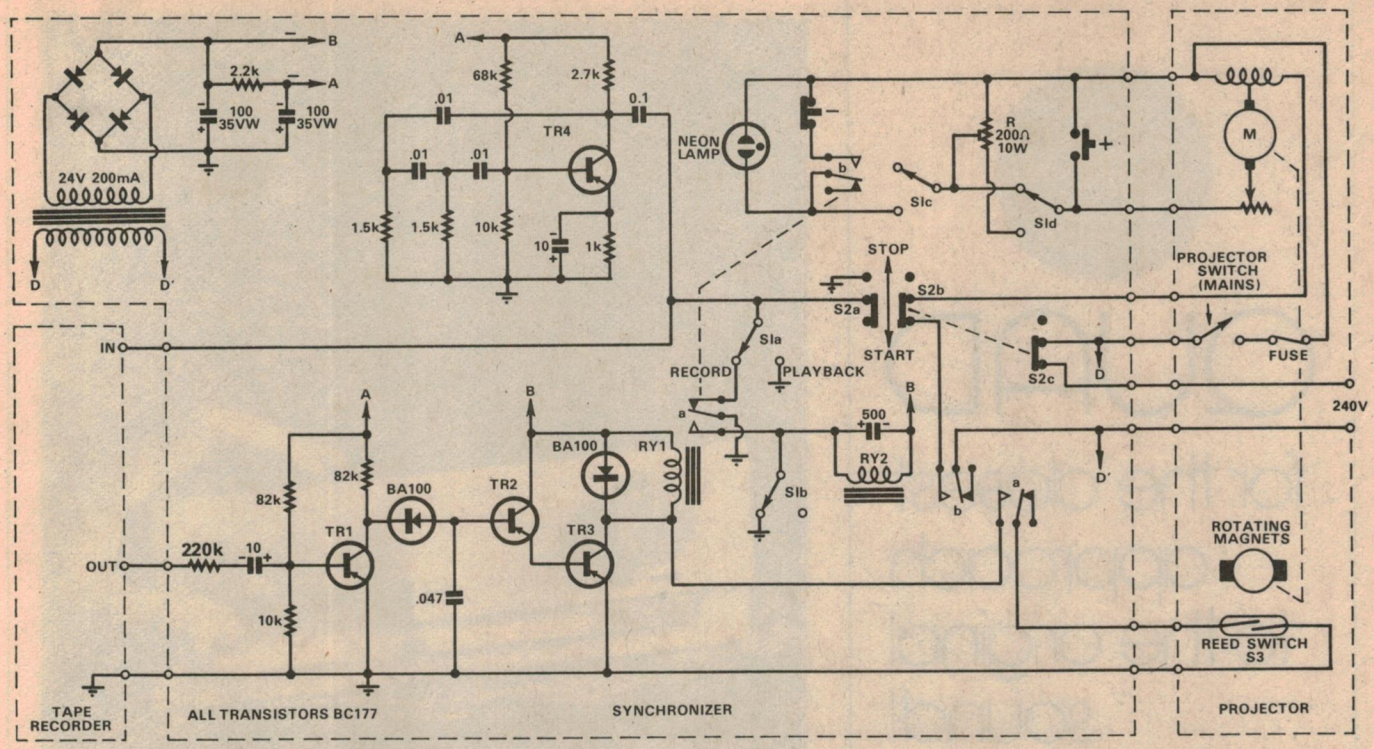


Fig 8: The circuit diagram of a non-discriminating tape contents synchroniser.

synchronisation channel (during the recording of this channel). The original text, plus music, can then be recorded on the other channel. An advantage of this method is that the soundtrack for the film can be recorded without having to run the projector.

This system is equipped with manual control buttons in the motor circuit (marked + and —) plus a "start-stop" switch (s2c). The first pulse to arrive from the tape recorder will activate Ry1, regardless of the position of the projector contact S3, because this contact circuit is held open by Ry2a.

Immediately Ry1 is activated by a tape pulse, Ry2 is activated via Ry1a. Relay Ry2 controls the projector, (Ry2a) holding the latter off in its unactivated position. When Ry2 is activated the projector starts and feeds its own speed indicating pulses into the control circuit. Relay Ry2 remains permanently on while ever Ry1 pulses, due to the large capacitor across the Ry2 coil.

Instructions for using this synchroniser are as follows:

Recording

- Let projector run until operational temperature is reached.
- Put film to be synchronised in projector and mark starting point.
- Put tape in recorder and mark starting point.
- Connect microphone and record player to tape recorder and make sure that signals will record on the track not used for sync signals.
- Set recorder controls to correct position.
- Switch synchroniser to "record" and switch on projector (projector should not start).
- Start tape recorder and synchroniser (push "start" button) at same time. Projector should start.
- Deliver text or commentary into microphone, timing it to suit the projected scenes. Mix music and/or sound effects as available.

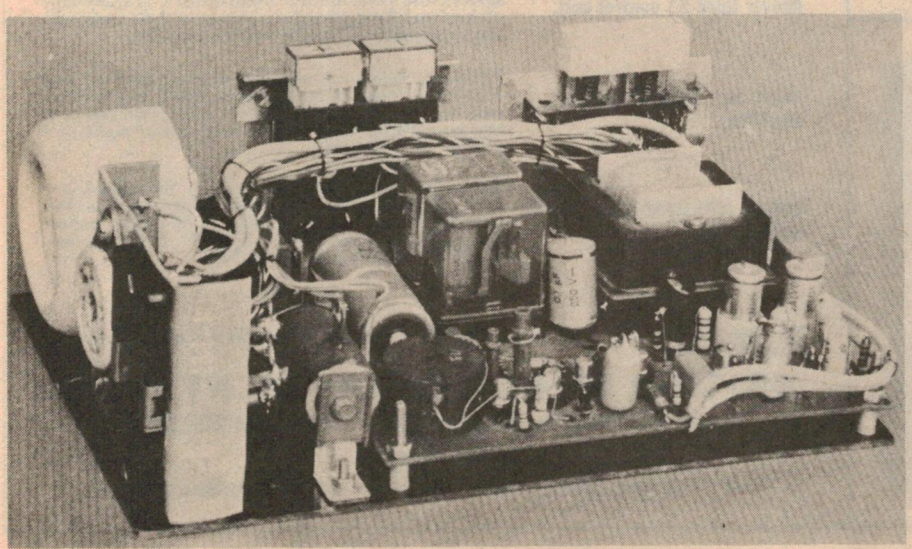
If no immediate sound track can be made, the method mentioned before can be used. In this case:

- Connect the microphone to the same track used for sync signals. Record a cue text at low level, using low gain control setting, or by whispering. Speech must be low relative to sync pulses.
- Projector is not needed beyond this stage.
- Switch tape recorder to "duoplay," connect record player, microphone and earphone.
- Start tape, listen through earphone to low level cue text and record music plus text on other track.

Playback:

- Let projector reach normal temperature.
- Set film and tape to markings.
- Press "start" button on synchroniser, and "start" switch on projector. (Projector will not start because of Ry2.)
- Start tape recorder — projector will start automatically.

One disadvantage of the non-discriminating control units described above is that they can only control the speed of the projector in one direction; ie the projector can only be slowed down. Therefore, before the soundtrack is recorded, or played back, the projector must be allowed to reach its normal operating temperature to ensure that it runs at a speed greater than the minimum speed for the control system to function correctly. A series of discriminating and integrating control circuits, to be described in next month's issue, are aimed at overcoming this problem.



At left is a typical synchronisation unit as constructed by the author. This unit is different in some respects to the circuit presented in Fig 8, but still uses the same basic principles detailed in this article.

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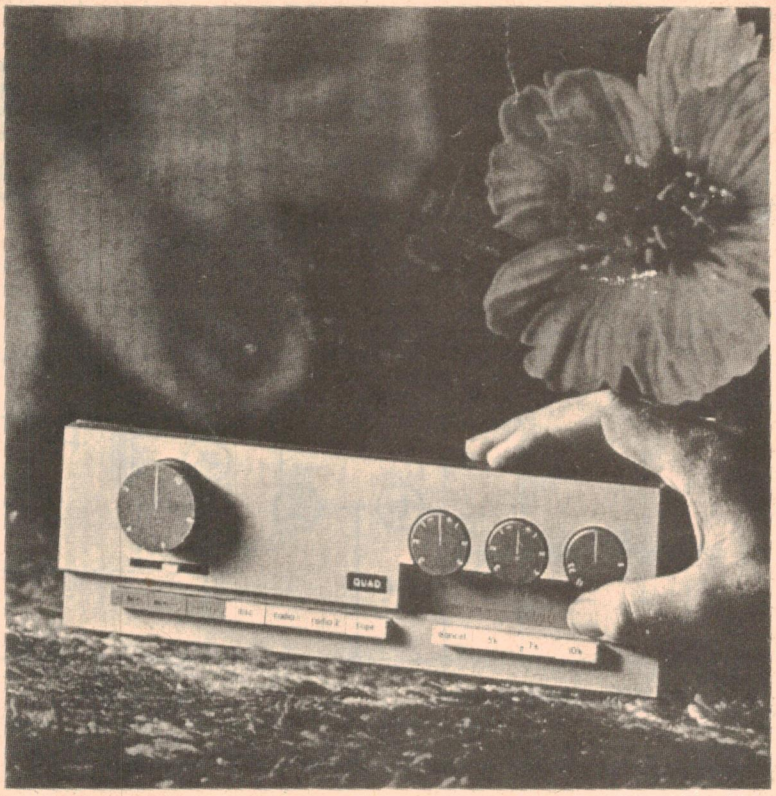

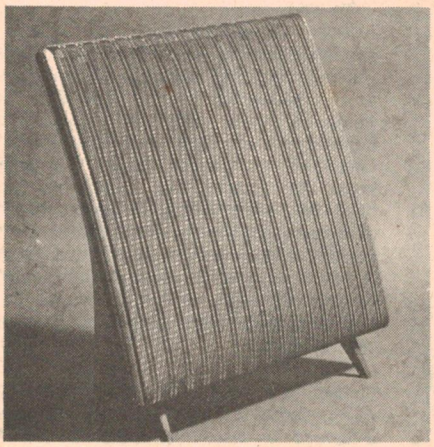

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FORUM

Conducted by Neville Williams

War in the air: Heavy losses feared

Imagine that your model plane is flying up there in the blue — the culmination of many months of hard work and many dollars of outlay. Suddenly it ignores your control signals and heads for the distant horizon. Or maybe it performs some crazy manoeuvre and plummets into the ground. How would you feel about it?

The sort of thing I have described is not unknown to people whose hobby is radio-controlled model aircraft, and they have to accept such incidents as philosophically as they can.

But, right now, they are stirred up about a proposal which they feel may increase the hazards to their chosen hobby. In short, they are worried about the pending introduction of a novice class amateur licence.

The viewpoint of modellers is well put by a letter which was sent some time ago to the Postmaster General by the Constellation Model Flying Club Inc, of 12 Martins Rd, Salisbury North, SA 5108. As you will note, the letter takes a side-swipe at people who are allegedly currently licensed amateurs and who allegedly indulge in the sport of "shooting down" radio controlled models.

Does this really happen, in a positive identifiable way, or is it convenient to blame seemingly inexplicable malfunctions on mischievous intruders? I imagine that there's room here for a lot of argument and recrimination.

But, to the letter:

Dear Sir,

It is with great concern that members of the above club read of the proposed opening of the 27MHz band to Novice Amateurs by your department, without reference to the present extensive use of the band by modellers.

Our club is one of many throughout Australia who are affiliated with the Royal Federation of Aero Clubs of Australia through the Model Aeronautical Association, membership of which is in excess of 3,500.

In fairness to your department, and to our members, we present the following facts in support of leaving the 27MHz band as is.

We have 58 members in the Constellation Model Flying Club, typical of the thousands who fly radio controlled models throughout Australia. The Club has assets in excess of $12,000 (10 acre flying field, tractor and grass cutter, double garage etc). Each of our flying members would have on the average about $700 tied up in radio control equipment, $400 of which is the airborne outfit consisting of receiver, servos, engine, accessories and airframe.

When you consider the amount our members have paid out in order to enjoy their chosen recreation on their own flying field, the private investment per head in our club alone is obviously quite substantial, and it is very sobering to think of a $400 machine plummeting to destruction at the hands of an indiscriminate novice amateur who has switched on without regard to consequence.

Deliberate "shooting down" of radio models is a real possibility, and indeed reports have been received from New South Wales that such Sunday sport is receiving the attention of some amateurs. Therefore the thousands of radio modellers are more in need of protection than further restriction.

The feasibility of such destruction as above can be readily appreciated when it is realised that although the modeller is allowed 2 watts, he rarely has more than 700mW available, whereas the novice amateur will be able to use 10 watts.

Under these conditions it is possible for a number of models flying at various locations to be brought down with the flick of an amateur's switch, the total damage as a result being several thousand dollars, not to mention the loss of many hundreds of hours of painstaking craftsmanship, and the possible hazard to spectators.

We, as practising modellers are painfully aware of the above, and know the truth from bitter experience.

On the whole, as dedicated hobbyists who readily appreciate the need for hobby participation, the amateurs are not likely to be so self centred and selfish as to insist on the use of the 27MHz band when the above facts are made known, especially as so little use is made of some frequencies already available to them.

In addition to the above, there are extensive industries within Australia (approx $1,000,000 annually) built around the radio control of models. These include manufacturers of aircraft kits, engines, radio control equipment, accessories electronic devices, and subsequently the retail outlets needed for such specialist items.

It is also generally known to the modellers that there are users of the 27MHz band in industry where factory cranes are radio controlled. The significance of this is obvious when one thinks of a wayward load of steel weighing several tons, and the consequential possibility of damage and loss of life due to novice amateur activities.

Our club is concerned with flying, but there are hundreds of users of radio control equipment who operate model boats and they in turn would be greatly affected by the 27MHz band proposals.

Many boat and aircraft competitions are dependent upon full use of the 27MHz band, this becoming more and more obvious as the popularity of these activities extends, as it has in recent years.

You are no doubt unaware of the magnitude of radio control activities, and we do suggest that in your capacity of Postmaster General you might take the steps necessary to have your responsible officers acquaint themselves of the real facts surrounding the use of the 27MHz band and as a club of many years' experience in radio control we offer your officers complete co-operation in any investigation they may see fit to instigate.

Enclosed you will find a newspaper feature concerning our club. The display featured attracted in excess of 2,500 people.

The proposed 27MHz activities would destroy these displays, it would render many types of competition impossible and cause great personal financial loss to a great number of modellers.

At this stage, we feel you have the supreme capability of intervention on our behalf to prevent any hardship to the modellers and thus by your considerate action prevent the need for further and expensive action.

On behalf of the above club,
(B. J. Horrocks for the Committee.)

A circulation list at the end of the letter indicates the existence of similar clubs in other states, along with a number of commercial interests.

The Model Aeronautical Association of Queensland, in a letter to the Postmaster General, supports the Constellation Model Flying Club and makes a number of other points, as under:

From details we have seen to date, it appears that there will be no great difficulty in meeting the requirements of the new novice licence and this will result in a large influx of new operators who will be attracted to the 27MHz band by the availablity of cheap equipment, converted "walkie

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"Deliberate shooting down of models"

talkies" etc, which by their mobility will create a high risk as far as we are concerned. Added to this their allowed power will be five times greater than ours.

The point made in the Constellation Club's letter concerning money spent on equipment is valid for all states, and as at this date the amateurs are not committed, surely some protection is warranted for the radio control operator to protect his investment.

When the operation of radio controlled models first commenced in Australia some twenty years ago, no one could foresee the tremendous growth which would occur when reliable commercial equipment became available. At that time your Department was possibly justified in allocating what was definitely an experimental project into the existing experimental band.

The same situation occurred in the USA when the availability of good commercial equipment attracted thousands to the hobby and, with the advent of their citizens band licence complete chaos resulted. The hobby and associated equipment manufacture is a multi million dollar concern in the USA and representation to the American FCC resulted in a number of frequency spots being arranged in the 27MHz band and the allocation of a band at 72-75MHz restricted entirely to radio control operation.

In our opinion, Australian authorities should now consider the future growth of this activity as the number of participants is increasing rapidly and Australian manufacturers and distributors are heavily involved in the supply of equipment.

While protection of the present frequency spots we are now using would be very acceptable at the moment, it is obvious that greater occupancy by other users of the 27MHz band will cause further conflict of interests in the future.

Our equipment is continually being up dated and improved, and a first owner's use of approximately three years is not unrealistic before equipment is traded on a later model. If consideration could be given to the establishment of a frequency allocation for radio control operators with say a two to three years protection of the existing frequency spots, it would give all concerned a chance to phase out equipment with a gradual occupancy of the new band at little cost.

Currently we cannot locate any usage of the 1MHz band from 34 to 35MHz and we think that if it is not in use it would be an ideal location for our activities.

Equipment in use is designed to operate either on 40 or 27MHz and a band at 34MHz would not entail any design changes and where an owner did not want to invest in a new unit, it is technically possible to change either of the existing frequencies to that under discussion.

It would be greatly appreciated if you would discuss with officers of your Department the following requests:

(a) As an interim measure protection be provided in any new regulations to cover a number of frequency spots in the 27MHz band, these spots to be subject to discussion between your officers and representatives of the radio control operators.

(b) That a new allocation approximately 500kC wide be set aside solely for radio control purposes in the 34-35MHz band or another suitable frequency. Operation in this band to be subject to a licence, not permit, with a yearly licence fee to compensate the Department for supervisory expenses.

R. Carpenter (Hon Sec).

We have received other approaches on the subject but the foregoing sums up quite well the case for consideration by model control enthusiasts.

While one can understand their apprehension, I have heard nothing or seen nothing to suggest that the apprehension is shared by anyone else, whether by amateur operators or by the administering authorities, who have replied formally to the correspondence.

What I sense is a conviction that the modellers, like other users of what has been called the "industrial band", have been given access to the particular frequencies "for better or for worse". If they choose to put at risk a costly flying model, it is on their own head!

And this is a very easy attitude to adopt — if you don't happen to own such a model.

A further reaction is that the frequencies are already open to existing amateurs and a variety of other users, including unauthorised "CB-ers", and the impact of novice amateurs will be minimal. Thus, if the problem is only minor now, there's no reason to expect a major one in the immediate future.

The design of the control equipment has also been questioned. To be sure, it is much more sophisticated than it was a few years back but does it still leave something to be desired? Are the receivers sufficiently selective in respect both to incoming carriers and the effects of those carriers. Does interference have to be catastrophic?

Mention is made of radio-controlled cranes, with the implication that these may well drop their loads spontaneously if affected by a random carrier. If that's the case, I'm going to stay well away from building sites in future!

And there's the matter of "amateurs" electronically shooting down flying models. Assuming that something like this did happen, were the culprits actually licenced amateurs or "pirates" using illegal CB gear?

If they were "pirates", and see this activity as a sport, they're still going to do their Red Baron thing, irrespective.

All told, I would judge the present climate for radio control modellers to be somewhat cool, albeit by circumstance rather than intent.

If publication of these letters draws attention to their predicament, it will have served its purpose.

Properties and Uses of

Ferrites

by W. H. DENNIS

The past three decades have seen the development of "ferrite" from a scientific curiosity into widespread use as components in a large variety of electronic equipment. This article describes the properties and uses of the different types of ferrite in the electronic industry.

The term "ferrite" is applied to a range of magnetic materials composed of oxides of iron (ferric oxide) and certain other metals. Ferrites are non-metallic, electrically non-conductive, hard, brittle and have to be ground to size because they are not machinable in any other way. Both "soft" and "hard" ferrite materials have been developed.

Soft ferrites are characterised by high permeability, low loss and low coercive force and correspondingly narrow hysteresis loops. The nickel-zinc-iron oxide and manganese-zinc-iron oxide compositions are the most important soft ferrites and constitute the majority of present-day production. Hard ferrites (permanent magnet materials) possess a high coercive force. The most important type in quantity production is the hexa-ferrite, barium ferrite.

The processes used in ferrite manufacture are similar to those used in the ceramic industry to produce pottery and in fact, ferrites are alluded to as ceramic magnets. Since ferrites are hard brittle material and can be shaped only by grinding, the sintering technique is the only practical manufacturing method of obtaining the various shapes required. The raw materials, usually oxides or carbonates of the metal in powder form, are mixed, pressed into briquettes for convenience in handling and heated to 1000C in order to form the ferrite.

It is possible to press the mixture to its final shape and to fire directly in one operation and in fact, many ferrite components are produced in this way. However, more consistent magnetic properties and closer control over dimensions are obtained by the following procedure;

The fired mixture is crushed and milled in a ball mill until the particle size is in the range 1 to 3 microns and then mixed with a bonding material such as sodium alginate, fed into a suitable die and pressed and sintered for about 30 minutes at a temperature in the region of 1200C. Approximately 16pc shrinkage occurs during sintering in all linear directions.

If an isotropic material is to be produced the individual crystals have to be oriented with their preferred axis parallel by means of a powerful magnetic field. This is performed after the pre-firing stage and during the shaping operation. In order to allow the crystals of ferrite to rotate freely under the action of the applied field and align themselves to the preferred direction the crystals are suspended in a water slurry. Provision is made for removing the excess liquid expelled during the pressing operation. The temperature and duration of the sintering process determines the size and grain structure of the crystallites.

In general, ferrites have negligible electrical conductivity. Their resistivity is many million times higher than that of iron so that they have insignificant energy loss at high frequencies.

The soft ferrites can be divided into two basic types. These are the manganese-zinc ferrites and the nickel-zinc ferrites and the broad division between the two types is that the MnZn ferrites have high permeability, low losses below about 1MHz and moderately high resistivity, whereas the NiZn ferrites have lower permeability, but high resistivity and can be used up to 50MHz or more. By varying the proportion of the principal oxide used and time and temperature employed in the sintering, the properties of these ferrites can be varied to meet the requirements of a particular application.

The most important parameters of magnets that determine their usefulness can be illustrated by the construction of a hysteresis loop which is a plot of flux density B gauss (SI units, tesla) against magnetic field strength H oersted (SI units, amperes per metre).

When the material is place in a field and a magnetising curve drawn for a complete cycle of magnetising current, it is found that the forward and return cycle do not coincide when the material has attainted a certain magnetisation it is reluctant to depart from that condition and lags to a certain extent so that the magnetisation does not run up and down in a single line but travels round in the form of a loop which is known as the hysteresis loop. The lagging of the magnetic flux behind the magnetising force is known as hysteresis (from a Greek word meaning "later"). The following information can be deduced from the loop.

1. Remanent induction (or remanence) is a measure of the residual flux density (Br) remaining when the magnetic field is removed.

2. Coercive force, Hc, is a measure of the force of the reverse magnetic field that must be applied to reduce the total flux density to zero after magnetising to saturation. It is a most important property required in a magnetic material for it registers the degree of magnetic performance and ranges in value from a fraction of an oersted in soft ferrites to several hundreds of oersteds in permanent ferrites.

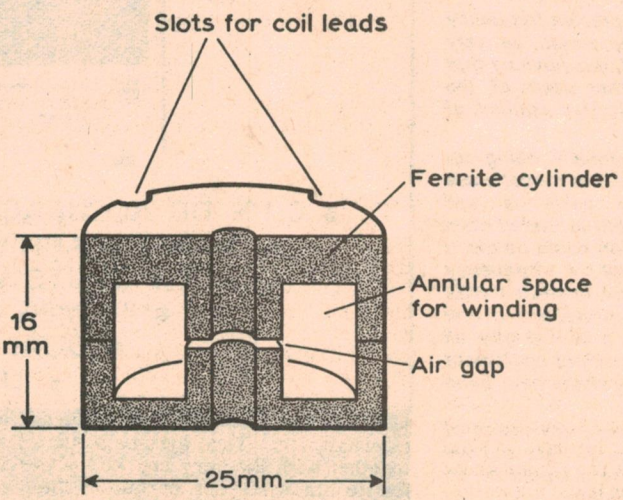
3. Permeability (u). At any value of H the permeability is given by $u = B / H$.

4. (BH)max. The product of the simultaneous values of B and H is proportional to energy density and hence is important as its maximum value represents the greatest available energy from a given unit volume of magnetic materials. This peak energy product is a useful yardstick to compare permanent magnetic materials.

5. Hysteresis losses. Resistance by the molecules of the material to being shifted every time the alternating current reverses creates friction which dissipates as heat. This energy loss is proportional to the area inside the loop and becomes particularly important when the material is subjected to rapid reversals of polarity such as those occurring in transformer cores.

The soft magnetic materials exhibit relatively narrow loops in the H direction. This is an indication of easy magnetisation and small hysteresis loss. In contrast the magnetically hard materials require large value of H for magnetisation and

Ferrite pot core



This diagram shows a typical ferrite pot core in cross-section.

(This article reprinted from "Electron" magazine, by arrangement.)

demagnetisation, thus ensuring large residual flux and high coercive force. Desirable properties of soft ferrites are high permeability, high saturation flux density, high resistivity and low coercive force. High permeability reduces the amount of core material for given reluctance. High saturation flux density reduces the amount of material required for high density devices. High resistivity reduces eddy current losses and low coercivity reduces the hysteresis loss and remanent flux.

Ferrite materials have properties which vary widely and correspondingly their use covers a wide range. Ferrites with narrow hysteresis loops are used for transformer (wide band, pulse and power) and induction cores at radio frequencies, ferrites with rectangular loops are of importance in information storage and switching devices whilst the gyromagnetic property lends itself to applications at microwave frequencies.

Inductor and transformer cores for radio and television applications constitute the largest use for soft ferrite materials. In the television industry, soft ferrites are used as core material in the deflection yoke and the EHT transformer. The core of the transformer has low loss at high flux densities (up to 0.2 Tesla) and functions at signal frequencies as high as 100kHz which is the effective maximum harmonic of the scan signal for a television picture tube.

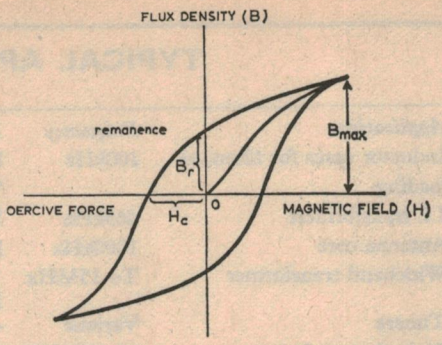
In all, about 250 grams of ferrites are used in a monochome television set while colour sets use considerably more. Another major use of soft ferrite is the ferrite aerial rod in portable radio receivers which dispenses with the need for an external antenna.

In the telecommunication field, inductor cores are used in large numbers as channel filters. In a typical carrier telephone terminal there may be several hundred filters in a single rack. The design of these filter circuits requires inductors that are as small as possible and offer a good compromise between the conflicting requirements of high performance, low loss and good stability. In addition, the inductors must be capable of initial adjustment to cover the inevitable tolerances on inductance.

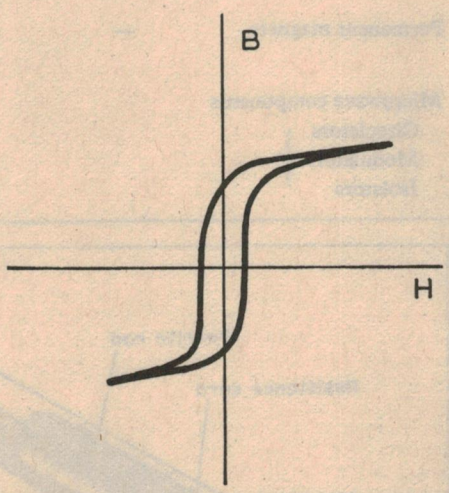
Pot cores are employed for wide band communication transformers and for various types of inductors operating over the low, medium and high frequency ranges. These cores consist of an outer cylinder with closed ends, the magnetic path being completed by a central cylindrical core, the winding being placed in the annular space. An air gap is introduced in the centre core and by choosing a suitable length for the effective permeability which controls the performance of this gap, the core may be arranged to suit a wide range of design requirements.

In the design of inductors and transformers, the so-called uQ product has been found to be a useful index of the quality of the material. In this function, "u" is the permeability of the core material and Q is the quality factor. It is this the measure of the ability of the component to store energy compared to the energy loss. Hence, it is called the "storage factor" and it is equal to the reciprocal of the dissipation factor or power factor of the component.

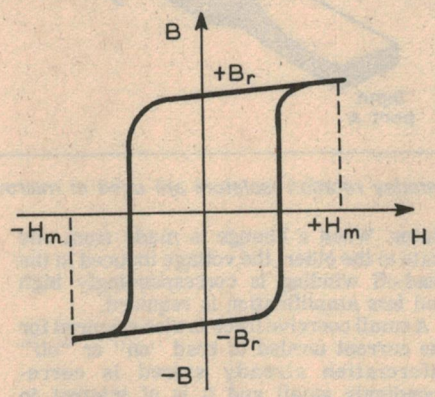
A high value of the product uQ produces large inductance per turn and thus allows a more efficient coil or a smaller coil. Typical values measured at 20kHz for a manganese zinc ferrite is 250 000 which is the highest uQ product of any commercial available magnetic material and compares with 2000 for iron dust and 10 000 for the nickel iron



This is a typical magnetisation curve for a permanent magnet material.



This is the magnetisation curve of a "soft" magnetic material used in transformers.



This is a "square loop" magnetisation curve for the material used in computer storage elements.

magnetic "permalloy."

Applications at microwave frequencies resulted from the discovery that an electromagnetic wave propagating through a ferrite actively interacts with the spinning electrons which gives the material its magnetic properties. This interaction causes a rotation of the plane of polarisation of the wave (the Faraday effect) and is also responsible for certain other phenomena, all of which can be controlled by the applied external field. This gyromagnetic effect together with the very low loss of certain ferrite materials has permitted their application to a class of non-reciprocal microwave circuit elements.

The devices utilising ferrites for this type of operation make use of the fact that ferrite material gives rise to considerable attenuation if the applied field strength is adjusted to cause resonance. The attenuation is non-reciprocal, ie the electromagnetic wave travelling in one direction is strongly attenuated while the reverse wave is almost wholly transmitted.

One of the most widely used of the devices operating on this principle is the Faraday rotation isolator, a two-port device having a forward loss of less than 1dB, a reverse attenuation of 20-30dB and bandwidth of operation approaching 10 pc.

The 45 twist in the waveguide rotates the wave coming from port A so that its electric field vectors are perpendicular to the resistance card (Lossy element). With this orientation the field is then rotated back to its original orientation when it passes through the ferrite rod and leaves the isolator at B essentially unmodified. A wave travelling from B to A rotates in the ferrite in the same direction relative to the magnetic field as the wave moving to the right, and is therefore oriented with its electric field vectors along the resistance card and is therefore absorbed. In this way the wave travelling to the left is approximately attenuated 30dB and the wave moving to the right suffers little loss.

Isolators are used in microwave systems to absorb energy travelling in the reverse direction to the main power flow in order to improve stability and performance. One example of its use is in the coupling of a microwave signal generator to a load network whereby all available power is delivered to the load but reflections from the load do not get transmitted back to the generator output terminals. As a consequence a matched load is effected in the generator and disturbances such as power output variations and changes in frequency with variations in the load impedance are avoided. Another device, known as the circulator, functions much like a traffic circle in that the circulator permits signal flow among a group of components only along certain specified directions. Circulators are used to connect components of a microwave system to the same antenna allowing, for example, a common antenna to be connected to both the transmitter and receiver of a radar system.

In connection with the aerial system, the variable phase shifter is perhaps one of the most important single components of any electronically steerable devices. For many microwave applications the long established mechanical rotating parabolic aerial is being superseded by ferrite aerial systems with electronic beam control. In such systems, which are known as phased arrays, a beam is produced which can be directed at various angles by changing the progressive phase shift along the array. When this phasing is continuously changed the beam scans through an angular sector without mechanical motion or change of frequency. This latter has several advantages such as the fact that the transmitting and receiving equipment required to accommodate any frequency change is both complicated and expensive. With ferrite phase shifters it is possible without mechanical motion to shift the direction of the beam of a large planar array in both horizontal and vertical directions simply by controlling the phasing.

Magnetostriction refers to the change of length of a ferromagnetic substance when it is magnetised. The phenomenon has important applications in devices known as magnetostrictive transducers which are

used for the reception and transmission of high frequency sound vibrations. The transducer operates on the principle which entails the lengthening or shortening that ferro-magnetic materials undergo when placed in a magnetic field. If current passes through a coil with a core of magnetostrictive material current variations are converted into mechanical vibrations. These mechanical oscillations can be utilised for example to drive the mechanical filter elements used in single sideband equipment designed to provide high attenuation at particular frequencies. Ferrites find some use in these and other magnetostrictive applications.

YIG Microwave ferrites belong in general to the Mg-Mn group of soft ferrites but in recent years a new group of ferrites have attracted a good deal of attention because of their unique characteristic. Designated by the initials YIG (Yttrium iron garnets), single crystals have an extremely small ferromagnetic resonance (1MHz) linewidth which gives high unloaded Q factors. Since microwave signals are efficiently coupled to the ferromagnetic resonance, YIGs can be used as magnetically tunable microwave resonators with unloaded Q factors up to 10 000 and a linear tuning range of more than ten times in frequency.

YIG resonators are used in devices such as tunable band pass or band stop filters. At room temperature pure YIG has a saturation magnetisation of approximately 0.2T and a Curie temperature of 275C. This allows operation at temperatures in excess of 100C and at frequencies from approximately 1780MHz through the millimetre range. Filters of pure YIG work very well above 1780MHz but the production of low frequency devices requires the substitution of gallium for some of the iron atoms. Many other devices are made with YIG resonators, eg fast switchable filters, tunable frequency discriminators, frequency meters, Gunn oscillators and tunable harmonic generators with varactor multipliers.

Ferrites can be used for suppression of parasitic oscillations or unwanted signals in electronic equipment. The low losses associated with soft ferrites apply over a specified frequency range. These losses increase rapidly above these frequencies and thus may be used for suppression of unwanted high frequencies. Suppression is obtained by means of one or more ferrite beads being threaded on to the wire in an appropriate section of the circuit.

Magnetic components made of a ferrite with an intrinsically rectangular hysteresis loop now find extensive use in computer stores, and for switching and logic applications.

The functioning of the digital computer requires the storage element to exhibit two well-defined and distinct stable states of magnetisation. These are the remanent states corresponding to the inductions +B and —B and may be taken to represent the two digits 0 and 1 which is the basis of the binary system in digital computers. The storage function depends on these two distinct states of remanence and the ease by which they may be selected and switched from one state to the other. The desired features in the ferrite are high saturation magnetisation for this yields a large separation between the two magnetisation states. When a change is made from one state to the other, the voltage induced in the read-off winding is correspondingly high and less amplification is required.

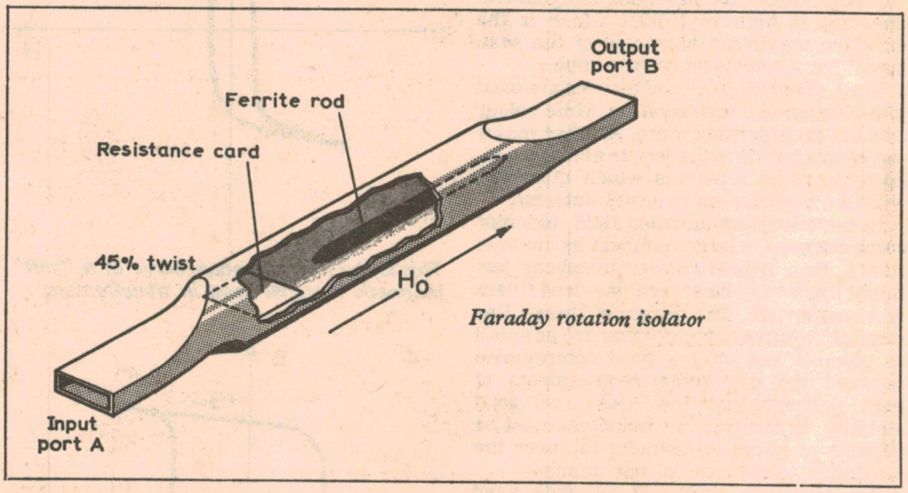
A small coercive force is also required for the current needed to read "on" or "off" information already stored is correspondingly small and it is of interest to consider the matter a little further. In a computer two wires pass through a ferrite toroid. In operation the magnetisation of the ring must reverse when both wires are energised, but not when only one of the wires is energised; in other words the reversal must take place at a field H — Hm (the switching field) but not at H — ½Hm. This infers that the hysteresis loop must be rectangular and further that the coercive field strength Hc must lie between ½Hm and Hm, hence Hc = ¾Hm. The switching field Hm is thus determined by the coercive field strength Hm = 4 / 3Hc.

The coercive field determines not only the switching field but also the time taken for a ferrite to reverse the magnetisation when driven by a pulse field, ie its switching time. In practice ring-shaped (toroidal) cores are the most common memory elements, other configurations being thin films or fine wires. The size of the cores is becoming increasingly smaller with the increased demand of large memory stores and an outside diameter of only 0.5mm is now common. High-speed digital computers have millions of these cores in their "memory" banks and function at switching speeds of one microsecond or less. The great majority of commercial rectangular loop ferrites are basically composed of manganese and magnesium with small amounts of oxides such as NiO, cuO and LiO, for these mixtures have the highest magnetisation.

Although the principal uses of the ferrites have been mentioned in the foregoing, the list is far from comprehensive. It is apparent, however, that sufficient has been said to show that the ferrites have become firmly established as an important class of magnet material in the electronic industry.

TYPICAL APPLICATIONS

Applications	*Frequency*	*Property*	*Typical Ferrite*
Inductor cores for filters or loading	100kHz	High μQ, low hysteresis loss Temperature stability	MnZn
I.f. transformers	465kHz	Ditto	NiZn
Antenna core	1000kHz	Ditto	NiZn
Wideband transformer	To 15MHz	High μ Low loss	MnZn NiZn
Tuners	Various	—	Ditto
Flyback transformer	15-100MHz	Low loss	Ditto
Recording heads	—	Ditto	Ditto
Memory and switching cores	Pulse	Fast flux reversal. Two stable states. Rectangular hysteresis loop	MgMn MnCu
Permanent magnets	—	High coercivity High (BH) max	Ba hexaferrite
Microwave components			
Circulators Modulators Isolators		Faraday rotation Ferromagnetic resonance Low dielectric loss	MgMn



Faraday rotation isolator

Faraday rotation isolators are used in microwave systems.

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3. "Controlling the properties of the electroceramic materials through their microstructure." Phillips Tech Rev, Vol 32, No 3 / 4, 1971.

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DIN PLUGS

AP-920: 2P —	34c
AP-935: 3P —	41c
AP-945: 4P—	54c
AP-955: 5P —	55c
AP-965: 6P —	65c

DIN SOCKETS

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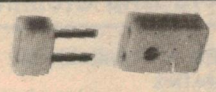
AS-930: 3P —	27c
AS-940: 4P —	28c
AS-950: 5P —	30c
AS-960: 6P —	32c

DIN LINE SOCKET
AS-956 58c
Mates with AP-955

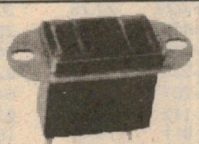
TV Feeder Connectors



AR-500 20c

AR-510 unpolarised 21c
AR-512 polarised 22c

2 PIN AC SOCKETS



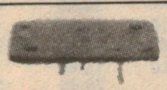
AR-602 socket 15c
AP-602 plug 36c

VALVE SOCKETS

AS-401-9 pin	12c
AS-402-7 pin	10c

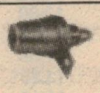
AS-420 COMPACTRON SOCKET 32c

AS-430 G. T. SOCKET 31c



AS-451 15c
TRANSISTOR SOCKET

RCA PIN JACK



AT-700 19c

CONNECTORS

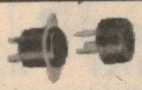
4 PIN CONNECTOR PLUG 10c
AP-040

4 PIN CONNECTOR SOCKET 10c
AS-040

Plug And Socket Sets

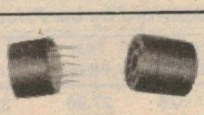
SCREW MOUNT.

AR-030, 3 conductor	46c
AR-040, 4 conductor	51c



BRACKET MOUNTING

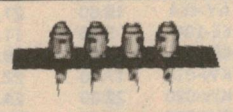
AR-130, 3 conductor	44c
AR-140, 4 conductor	48c



AR-170 (7 way)	59c
AR-190 (9 way)	64c

AR-430 (3 pin)	59c
AR-440 (4 pin)	66c

RCA Pin And Jack Strips

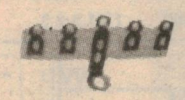


AT-630, 1 pin —	35c
AT-631, 2 pin —	40c
AT-634, 4 pin —	75c
AT-636, 6 pin —	$1.00

Screw Terminal Strips

2 pin — AT 522 —	30c
3 pin — AT 523 —	33c
4 pin — AT 524 —	44c
5 pin — AT 525 —	47c
6 pin — AT 526 —	66c

Terminal Earth Strips



MINIATURE

3 way	10c
5 way (as above)	14c
8 way	23c

STANDARD

3 way	8c
5 way	14c
8 way	24c

BINDING POSTS

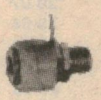
Yellow
Red, Black
12 M / M 6c
AE-101

Red, Black
12 M / M 19c
AE-110
Captive or Free Head

Red, Black
16 M / M 40c
AE-120

BANANA PLUG

Red, Black
AY-301 13c



Tip Jack for above
Red, Black
AY-351 14c

ALLIGATOR GRIPS

Red, Black.

AY-420 (31mm) —	7c
AY-430 (45mm) —	8c
AY-440 (70mm) —	10c

BATTERY CLIP

Red, Black

AY-451 (50mm) —	18c
AY-452 (60mm) —	24c
AY-453 (90mm) —	30c
AY-454 (90mm H.D.) —	40c

ARROW TYPE TIP

Red, Black
For Posts
AY-201 12c

BEZELS

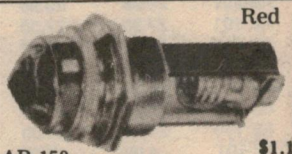
NEON
Red, Green, Amber, Clear
AB-002 43c

Red, Green, Amber with 6.3v Globe
AB-101 50c

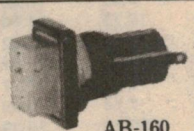
Red, Green, Amber with 6.3V Globe
AB-111 50c

Red, Green, Amber without globe
AB-120 51c

Red
AB-144 74c



Red
AB-150 $1.15



Red, White, Green
AB-160 44c

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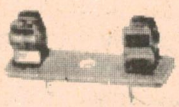
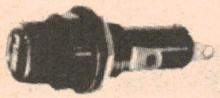


AH 601 STANDARD 8c
TF 758 MINIATURE 8c



AH 720 STANDARD 45c
AH 750 MINIATURE 42c

AH-730
IN LINE TYPE 16c

FUSES

STANDARD 3AG 12cents ea.
100MA to 10A

MINIATURE TYPE
20mm x 5mm 12 cents
.5A 1A 2A 3Amp ea.

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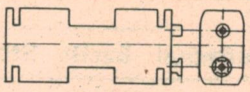

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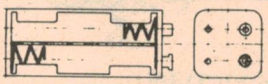

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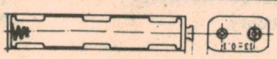

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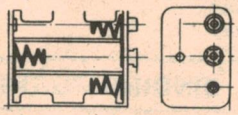

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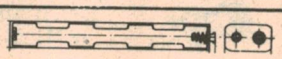

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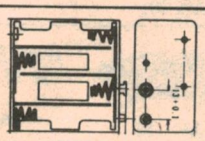

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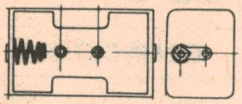

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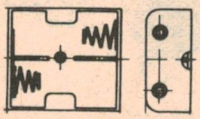

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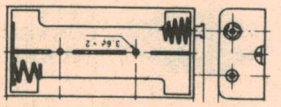

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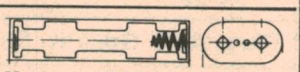

AH-916 UM 2 x 4 79c

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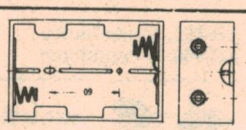
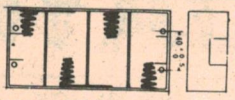
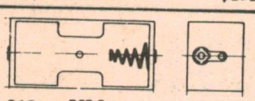


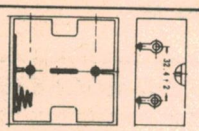
AH-922 UM 1 x 4 $1.40



AH-924 UM x 1 x 4 $1.40

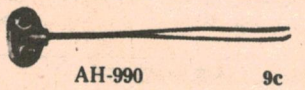


AH-918 UM 1 x 1 45c

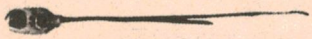


AH-920 UM 1 x 2 71c

BATTERY-SNAPS



AH-990 9c



AH-991 9c

Cord Grip Grommets

TYPE A — Suitable for 3 core flex 9c
TYPE B — Suitable for figure 8 types 7c

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AJ-332	28.50	36.34
AJ-339	12.60	14.49
AP-040	4.65	5.35
AP-301	9.44	18.85
AP-311	6.75	7.76
AP-320	14.10	16.22
AP-325	22.05	28.11
AP-330	23.25	29.64
AP-602	9.60	10.04
AP-920	14.25	18.17
AP-935	17.55	22.38
AP-945	22.80	29.07
AP-955	23.25	29.64
AP-965	27.60	35.19
AR-030	19.65	25.05
AR-040	21.45	27.35
AR-130	18.45	23.53
AR-140	20.25	25.82
AR-170	24.90	31.75
AR-190	27.30	34.81
AR-430	25.20	32.13
AR-440	27.90	35.57
AR-500	8.33	10.62
AR-602	6.90	7.94
AS-040	4.05	4.67
AS-401	4.80	6.12
AS-402	4.05	5.16
AS-420	13.35	17.02
AS-430	12.90	16.45
AS-451	6.30	8.03
AS-920	11.22	14.31
AS-930	11.25	14.34
AS-940	12.00	15.30
AS-950	12.75	16.26
AS-960	13.35	17.02
AS-956	24.60	31.37
AT-522	12.60	16.07
AT-523	14.40	18.36
AT-524	18.75	23.9
AT-525	19.95	25.44
AT-526	27.90	35.57
AT-631	27.27	34.77
AT-634	32.70	41.69
AT-636	46.87	59.77
AT-700	8.10	10.33
AY-201	5.40	6.21
AY-301	5.70	6.56
AY-351	6.60	7.59
AY-420	3.15	3.62
AY-430	3.60	4.14
AY-440	4.35	5.00
AY-451	8.10	9.32
AY-452	10.95	12.59
AY-453	14.10	16.21
AY-454	18.60	21.39
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KW-010	17.40	22.19
KW-020	22.80	29.07
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KW-040	20.40	26.00
KW-050	20.40	26.00
KW-060	20.40	26.00
KW-070	26.55	33.85
KW-080	30.75	35.36
KW-090	24.60	28.29
KW-091	30.75	35.36
KW-100	30.75	35.36
KW-110	22.80	29.07
KW-130	22.80	29.07
KW-140	22.80	29.07
KW-150	25.95	33.09
KW-160	22.80	29.07
KW-170	22.80	29.07
KW-180	22.80	29.07
KW-190	25.95	33.09
KW-200	20.40	26.01
KW-210	22.80	29.07
KW-220	27.75	31.91
SA-110	22.50	25.88
SA-210	26.25	30.19
SA-220	28.50	32.78
SA-201	47.55	54.68
SA-112	24.12	27.74
SC-011	14.40	16.56
SE-110	9.30	11.86
SE-120	8.85	11.28
SE-122	9.30	11.86
SE-210	9.90	12.62
SE-211	8.25	10.52
SE-212	13.95	17.79
SE-220	18.90	24.10
SE-230	9.90	12.62
SE-330	22.80	29.07
SE-530	27.45	35.00
SI-110	14.40	18.36
SI-111	22.05	28.11
SI-220	22.50	28.69
SU-010	46.35	53.30
SU-015	46.35	53.30
SU-020	52.35	60.20
SU-040	52.35	60.20
SX-110	10.20	13.05
SX-120	14.43	18.40
SY-010	15.45	19.70
Z1	29.85	38.05
Z2	19.67	25.07
Z3	17.07	21.76
Z4	15.39	19.62
Z5	14.54	18.53
Z6	12.80	16.31
Z7	14.20	18.11
Z8	11.69	14.90
Z9	13.20	16.83
Z10	11.13	14.19

THE SERVICEMAN

The case of the slow running motor

Among the numerous problems which servicemen encounter, new manufacturing techniques and people who insist on butchering equipment are just two of the more common ones. Put them together and you are likely to have a real head-scratching situation.

This is a story about a Japanese cassette recorder. It was delivered to the shop with the rather terse comment that the "motor runs slow." While this statement proved to be accurate enough in itself, it was only a small part of the overall picture. As I was to discover, someone had obviously "had a go" before the unit came to me, found himself out of his depth, and given up in despair. Unfortunately, no one bothered to tell me.

The part about the motor running slow proved to be correct — for the very simple reason that the batteries were so sick that it was a wonder it rant at all. I consigned them to the rubbish bin.

One of the most valuable devices on a service bench is a variable regulated power supply which one can substitute for batteries in the wide range of battery operated devices which one encounters these days. For one thing, it avoids the complications of providing batteries for test purposes, and ensuring that they are fresh.

More importantly, if properly metered, it can reveal a lot about the behaviour of a set before any other tests are made. One soon learns what kind of standing current to expect from typical units, and a value which is too low or too high immediately indicates a number of likely faults.

In this case the reaction was quite drastic: the current meter swung up to 500mA at switch on. I switched off hurriedly, hoping that nothing had been damaged. Then I realised that the owner had probably abused it in a similar manner, for much longer periods, before he brought it to me. If anything was going to pack up it would have done so by now.

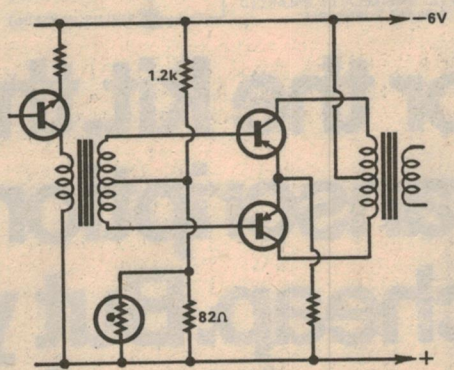
The complaint about the motor running slow suggested that this might be the culprit. It wouldn't be hard to visualise a fault which would draw excess current and cause the motor to run slow at the same time. So I traced out the motor leads, disconnected them from the rest of the circuit, and connected them directly to the power supply. Not only did the motor appear to run normally, but it drew a mere 80mA.

This left 420mA to be accounted for, of which at least 400 I reckoned to be spurious. I made a quick check of the drain again, confirmed these figures, and also established that the output transistors were getting uncomfortably hot.

Since these transistors were relatively easy to get at, and I had some spares on hand, I pulled them out and tacked in two new ones. The result was exactly the same, so I replaced the original ones.

Now what? Well, if the transistors themselves were OK, then the fault was obviously in the operating conditions, and almost certainly in the bias network. But at this point I faced a couple of serious problems. The unit was one of the increasing number from Japan which are no longer using discrete resistors. In their place are small black blobs, about ⅛in square, printed along with the copper pattern.

While this is no doubt an excellent idea in many ways it presents the problem that, as being used, there are no markings of any kind to indicate the resistor values. Thus,



The output stage was conventional, but difficult to service because none of the resistor values was marked.

without a manual, there is no way of knowing what a resistor value should be, and I had no manual. All that one can do is measure any suspected resistor and compare the measured value with what would seem to be logical in that part of the circuit. A pretty rough and ready arrangement, to say the least.

Fortunately, this biasing network was fairly conventional. It consisted of a voltage divider network from the active (negative) rail to the common rail, made up of a resistor from the active rail to the bases, and a resistor and thermistor in parallel from the bases to the common rail. The job of the thermistor is to pull the bias down with increasing temperature, to offset the natural tendency for the transistors to draw more current under these conditions.

But there remained the vital question as to what the actual values should be. From experience I would expect the resistor from the active rail to be anywhere from 1k to 5 or 6k and the one to the common rail to be between 75 and 200 ohms. The thermistor is even more difficult to pin a value on.

It was against this background that I checked the two resistors. The one from the active rail read about 1.2k — which was not unreasonable. But the other one was simply open circuit, and the whole situation suddenly became quite clear.

With this resistor out of the divider network, the forward bias on the ouput stages would have risen substantially. While the thermistor would pass some current, its resistance would normally be at least as high, and usually higher than that of its shunt resistor. Little wonder that the ouput transistors behaved as they did.

Closer inspection revealed why the resistor was open circuit: it had been deliberately cut, probably with a razor blade. Why? Your guess is as good as mine. In fact, I have almost given up trying to work out why people do some of the things they do to transistor sets. All I know is a very large proportion of sets which I handle have been butchered in some way.

More important was what to do about it. I still had no idea what its original value was, yet a suitable value had to be provided. I fished out a pot of about 500 ohms and connected it into circuit as a variable resistor. With a little juggling I quickly brought the standing current down to about 12mA, a figure which is fairly typical of this type of circuit.

Then I checked overall performance, particularly for distortion and power output, and juggled the pot a little for what appeared to be optimum results. Finally I fitted a fixed resistor having the nearest standard value to that measured on the pot; an 82 ohm resistor as it turned out, and the system seemed to be perfectly happy with this arrangement.

Finally I reconnected the motor, fitted new batteries, and tidied things up generally. The customer was delighted with the result, but I never did find out how it all started.

Some time ago (September 1972) I told a brief story about an audio enthusiast — with more enthusiasm than technical background — who wanted to paint the cones of his high quality, and very expensive, speakers, simply because he disliked the appearance of the dark cones behind the grille cloth.

Prompted by my apprehension at such sacrilege, an Atherton (Queensland) reader submits his own story, which has a happier ending.

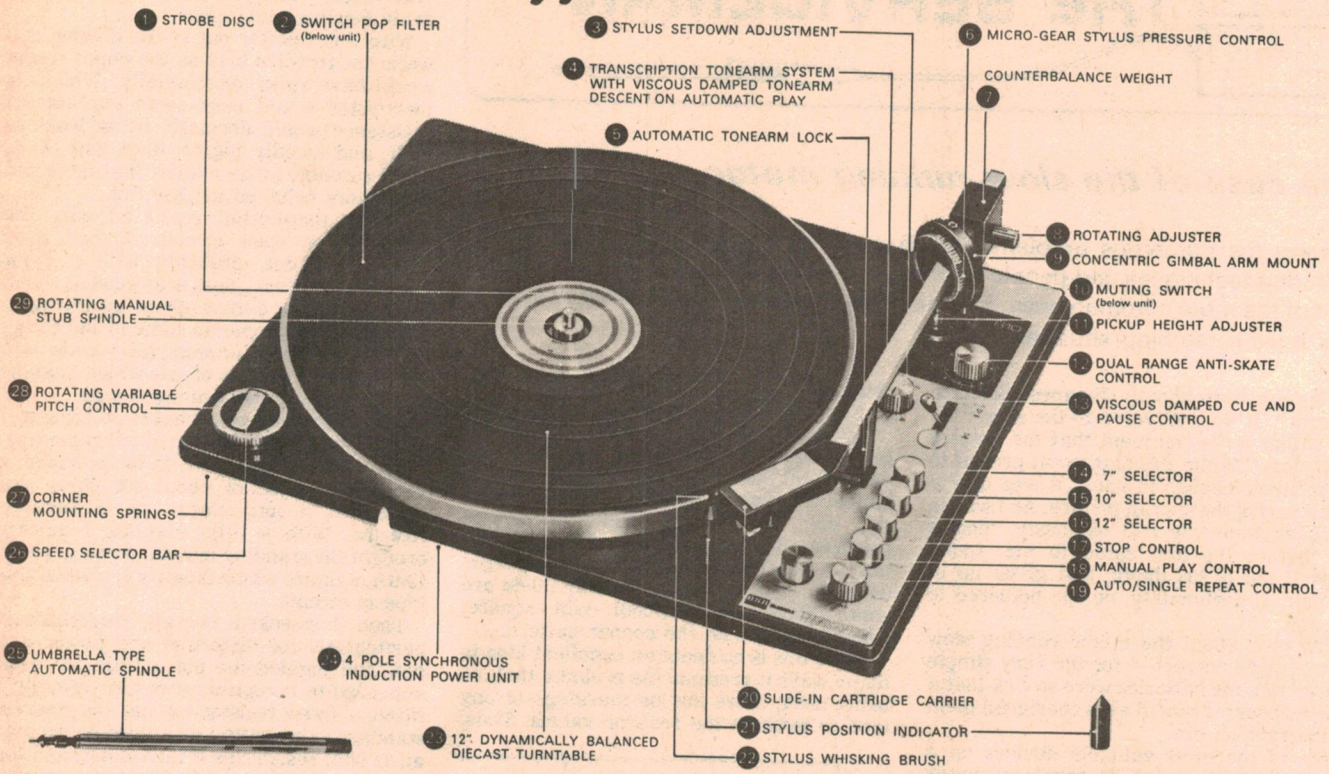
"Needing an extension speaker for a cassette player, a search of the 'junk box' revealed a suitable 5 inch 8 ohm speaker, but the outside edge of the paper cone was badly damaged with a number of cracks and tears big enough to see through.

"Having nothing to lose I brought the cone back into shape with wood and cardboard chocks and Selleys paper glue to the damaged portions, with repeated applications over a few days until the gaps were filled. However, output was poor as the cone had lost its original stiffness. As an experiment I brushed Selley's paper glue onto the whole of the cone, front and back.

"When the cone was dry I hooked it up again and was amazed at the performance, which now far exceeds the original. Both bass and high range were so improved that I built the speaker into an airtight enclosure without the tweeter I was planning to add.

"After several months' use it is still behaving splendidly and I have also repaired a hole in a 10" speaker using

"Taking it all together — performance, features, styling — the BSR 810 moves into ranking place among the best automatics we know of. And at its price, the others may well be in for a real contest." Hi-Fidelity Magazine, May 1972.



At $149* for the kit, the brilliant BSR/810 transcription turntable is hardly cheap. But your ears will tell you it's a bargain.

* At recommended retail price.

BSR, manufacturers of most of the world's turntables, have now turned the tables on expensive units.

And here are the features that make the 810 such an attractive proposition: the unit weighs 17 lbs — the diecast turntable alone is a solid, dynamically balanced 7½ lbs. A 4-pole beautifully balanced synchronous motor automatically compensates for any fluctuation in voltage input, or for any record load. A pitch control gives absolute accuracy of speed, utilising a stroboscopic centre plate.

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Single to automatic play conversion is achieved with the interchangeable umbrella centre spindle.

Start-stop, record size control and auto repeat and manual conversion are actuated by push button controls set in a handsome brushed aluminium panel.

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cigarette paper to help support the glue.

"The glue film is sufficiently flexible to be ideal for repairs and stiff enough to improve speakers which break down under load."

Yours faithfully,
W.W.

Thank you, W.W., for an interesting story which could undoubtedly help other readers in a similar situation. Nevertheless, I feel I must sound a word of caution. The operative phrase in W.W.'s letter was, "Having nothing to lose . . ." and I would like to emphasise it.

It is one thing to salvage a speaker from the junk box — and even improve on its original performance — but it is something else again to attack a perfectly good speaker, particularly one costing half a week's wages or more, and hope to improve on the maker's performance. Such an act would be foolish in the extreme.

In sounding this caution I don't wish to imply that W.W. even hinted at such an idea; he didn't. But some people can read into a story what they want to be told and I would hate to have a pair of top price speakers on my conscience.

Finally, a follow up on one of the stories I told in the October issue. Readers may remember the dear old lady who burst out of the building entrance, calling "Wait, wait, the TV set's blown up!" when, in fact, it was the table lamp on top of the cabinet. Well here are a couple more in similar vein.

The first involves one of my customers. She is the mother of two teenage daughters who usually go their own way of a Saturday night, leaving Mum at home to watch TV. And, since she likes to wait up until the girls come home she is often still watching in the early hours of the morning.

The incident occurred about 1 am. As she described it there was a bright flash of light from the screen of the TV set, a loud noise, the radiator went momentarily dim, and there was a smell of something burning. In a panic — and I can't say I blame her, with a set of symptoms like that — she rushed across the room and switched off the TV set. Nor was she game to switch it on again.

First thing Monday morning she was on the phone with the sad story. And, since I had serviced the set only a few days before, the implication was obvious: it was my responsibility. Puzzled as to what could have gone wrong I made it my first call.

As I implied earlier, they were a pretty imposing set of symptoms; not the kind of thing that someone would imagine. I wasn't too keen to switch the set on until I had given it the once over.

Some 15 minutes later I wasn't so sure that she hadn't imagined the whole thing; or fallen asleep and dreamt it. It was as clean a TV chassis as I've ever seen. No black stains, no smell of burnt insulation; nothing to give the slightest hint of trouble.

But the lady was adamant; she was sure it had happened. So I said, "Well, stand clear, and it's Sydney or the bush." She took me literally and scurried for cover as I pressed the switch. The result was a dreadful anticlimax. No flashes, no bangs, no smell. Just a TV set playing normally.

I shrugged my shoulders. There was little more that I could do unless something blew up in the next few minutes. Then I spotted it. While talking to the lady I happened to look up. Mounted on the ceiling was an elaborate circular fluorescent light fitting and on the ceiling itself a large black stain.

"Is your fluorescent light all right?" I asked. "Yes, quite all right," she replied looking puzzled. I walked over to the switch and flicked it on. The light came up normally, with no sign of distress. Equally puzzled I switched it off, waited a few moments, and tried again. Jackpot! A flash of light, a loud crack and, after a few moments, a smell of burning.

"Lady," I said, "you don't need me; you need an electrician."

Now that I knew the cause it was easy to see how the lady had been fooled. The position of the light, the TV set, and her favourite chair were such that she received a perfect reflection of the light fitting on the TV screen. That, plus the fact that the set had just been serviced was enough to convince her that it was the TV set which had "blown up."

The other story came from a colleague, who was reminded of the incident by my October story. It happened some years ago, on an occasion when he had just installed a brand new set in a customer's home. Less than 24 hours later he received a panic call, "The TV set's blown up and the house is full of the smell of burning rubber."

In fact, he found that the power fuse had blown, and careful questioning established that the washing machine had been on at the same time as the TV set. And, since the smell of rubber seemed strongest near the washing machine, he strongly suspected it was the culprit.

But he was not prepared for what he found. In loading the machine the lady of the house had somehow managed to include a wire coathanger in the load. This had jammed under the agitator and the smell of burning rubber had presumably come from the rubber drive belt valiantly trying to move the agitator. Finally the whole mechanism jammed and the overloaded motor took out the fuse.

Which very effectively put the TV set out of action — so they called the TV serviceman. Who else?

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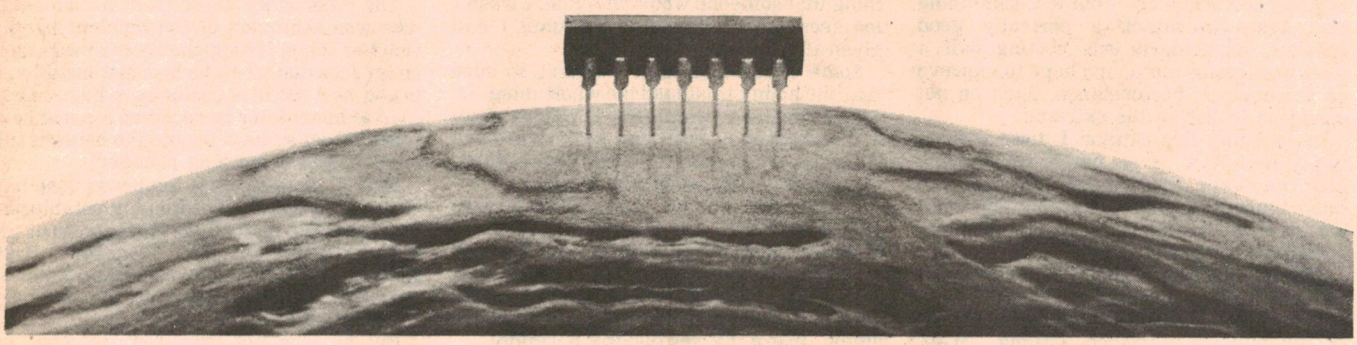

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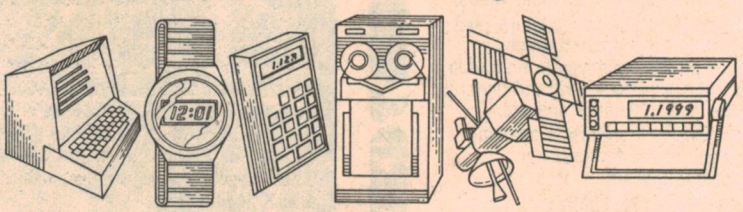

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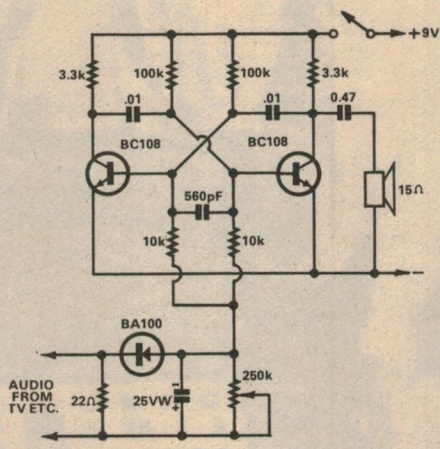
CIRCUIT & DESIGN IDEAS

Interesting circuit ideas and design notes selected by the Editor from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsibility cannot be accepted. Contributions to this section are always welcome.

Audio sentry siren

A problem encountered in TV and audio servicing is intermittent sound. This can be a difficult fault to locate, as the unit has to be run for long periods with the volume turned up. Another person may turn the volume down and so the problem is compounded. Clearly, the need is for an alarm to attract attention when the audio fails. This circuit will meet that requirement.

Output of the audio amplifier for test is taken via two clip leads. A 22 ohm resistor across the input is to maintain a load for the amplifier under test. The audio is rectified and a negative charge appears across the 640uF capacitor, the discharge rate of which is determined by the setting of the 250k potentiometer. The voltage is fed to the base of each transistor via the 10k resistors, thereby holding the astable multivibrator at cut off and there will be no output. If the audio stops or falls to a low level the voltage across the 640uF capacitor will fall and so allow the multivibrator to function. The



audio tone produced is fed to a small 15 ohm speaker.

The unit is powered by a 9V transistor radio battery which should give a long life as the cut-off state current is only 20uA rising to 4mA when conducting. The maximum delay time is about 35 seconds and this is ample for most breaks between programs, etc. By progressively reducing the value of the 250k potentiometer the delay can be reduced to under 1 second. The audio tone may be altered by changing the value of the two .01uF feedback capacitors. The 560pF capacitor is additional feedback to ensure reliable starting. Although the drive to the speaker is small, it seems to be adequate.

I built my unit into an old remote control handset from a TV set, using the existing speaker and switch combination. This device is valuable in tracing intermittent faults in the audio systems in TV sets, radio sets, record players, etc.

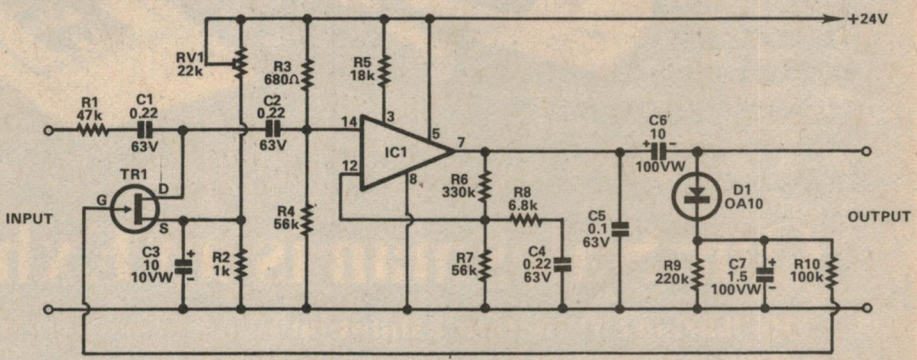
(By Mr J. R. O'Shea, 3 Broad Street. Cabramatta, NSW 2166.)

An integrated circuit speech compressor

The compressor uses an audio amplifier with automatic level control, and the input attenuator is voltage-controlled by rectified audio from the output of the amplifier. An integrated circuit was chosen for the amplifier, to simplify construction and ensure repeatability of results; the devide used was a General Electric PA237, in a circuit described in the manufacturer's application note. It was selected for its low output impedance and high peak current capability.

The diode D1 rectifies audio and charges C7, which discharges through R9 and controls the FET via R10. In order to have a fast attack time and to work on sudden speech peaks the charging time constant must be very small, and this is the reason for using a power amplifier with a low output impedance. The diode also has a low resistance, which helps in this respect. They decay time is made much longer to hold down noise between syllables.

The voltage-controlled attenuator, consisting of a FET shunted across the input of the amplifier, acts in conjunction with R1 as a potential divider. When the FET is turned off, the system behaves as an ordinary amplifier with a gain of 24dB. When it is turned on fully no further decrease in resistance takes place and the system



functions again as a straight amplifier with a gain in the region —6 to +4dB, depending on the selected compression ratio. It will handle an input with a range of —20 or —30 to about 0dB, again depending on the compression ratio. The compression ratio itself is varied by adjusting the source bias voltage with RV1. The onset of compression can be altered by varying the gain of the amplifier, by changing the value of R8. Total harmonic distortion with 0dB input is about 2 per cent.

A selection of MPF103s was tried in the prototype and all gave similar results, although requiring slightly different source voltages to achieve the same compression ratio. The current consumed is about 20mA when working into a 600 ohm load. If a band-limiting filter is used, it should be connected to the output of the compressor, or else the action will reduce the effectiveness of the filter.

(By A. Langton, in "Radio Communication".)

Editorial note: We understand that the General Electric PA237 IC is no longer available in this country at least but a similar op amp should be satisfactory.

Water level alarm

Here is a water level alarm which was developed to cope with a situation in my home. The lady of the house has a semi-automatic washing machine and from time to time she would go away when water was running to fill the machine and the inevitable spillage would occur, thus flooding the laundry and environs. I built this little device which works well and has given no trouble over the last 8 or 9 months.

The circuit is very simple but the alarm mechanism must be a bell or buzzer, or

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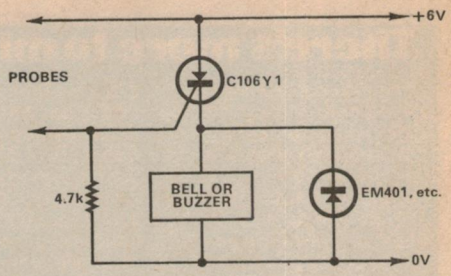


something which employs a constantly make and break arrangement. If this is not done, an on-off switch or reset button must be used.

I built mine in a metal case but other ideas could be used. The probe used was a 2-pin mains type plug and the battery an Eveready type 509, which should have a very long life. The probe is arranged so that the pins are pointing downwards and at the top level of water required. When the water reaches the probe tips the alarm sounds. The alarm stops automatically as soon as the probe is removed from the water.

(By Mr A. Mann, 6 Jenkins Street, Noble Park, Victoria 3174.)

Phase-locked loop demodulator

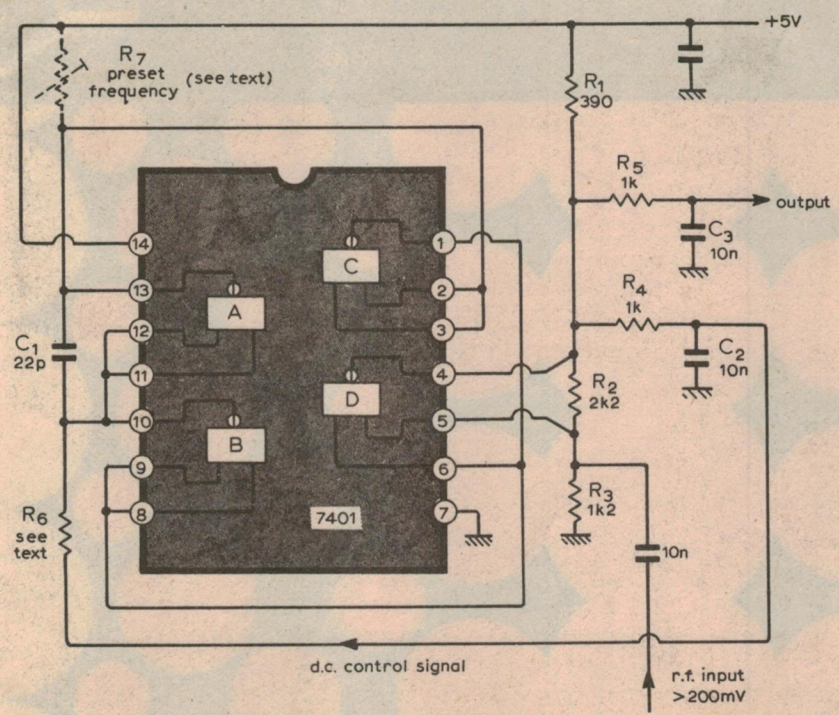
Here is a phase-locked loop demodulator which is both simple and inexpensive. Gates A, B and C constitute a relaxation type of voltage-controlled oscillator whose output frequency is determined by the value of C1 and positive current sources supplying pins 10 and 13. It should be noted, however, that the inputs to gates A and C supply part and whole of those currents respectively. Similarly, no resistor is required on the output of gate C, pull-up being provided by the input current to gate B.

D is arranged such that when pin 6 is high the gate is biased by R2 and R3 to operate as a linear amplifier for the input signal. In operation, however, pin 6 is alternately high and low due to the oscillator output and hence gate D performs as an amplifying phase detector. The output from this stage is fed via the low-pass filter R4 and C2 to the voltage-controlled oscillator, completing the phase-lock loop. A separate filter R5 and C3 provides the audio output.

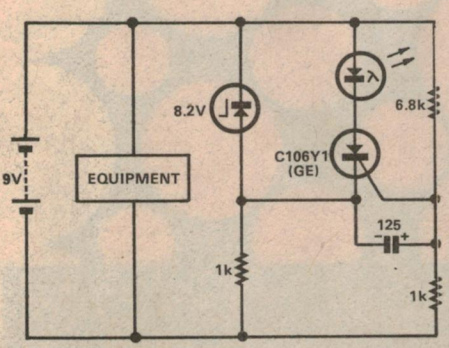
With C2 equal to 22pF the circuit operates at a frequency of approximately 10MHz. Making R6 270 ohms or 10k maintains lock over a frequency range of 2MHz or 300 kHz respectively. In both cases the output swing is just over one volt. An additional component R7 may be incorporated if desired to obtain fine adjustment of the operating frequency.

Although this circuit is somewhat dependent on the device characteristics which will vary from one sample to another, it is capable of giving satisfactory performance for most amateur experimenters' requirements. The small size and very low cost make it eligible for substitution into existing equipment using other types of demodulation.

(By Rodney King, in "Wireless World".)



Low battery voltage indicator



This circuit was devised to indicate when the voltage of a battery falls below a minimum acceptable value during a long period of use.

The design is for a 9 volt version, but can easily be adapted to suit any supply voltage. In this particular case the LED lights up when the supply voltage falls to 8.3V — this minimum voltage is determined by choice of circuit components. The LED used is a Hewlett-Packard 5082-4440. The zener diode is a BZY85 / C8V2 400mW, but in this circuit its avalanche point is only 7.7V due to the low current drawn. The circuit draws about 2.5mA normally, and 7mA when the thyrister conducts. The 125uF capacitor is included to prevent pulses triggering the thyristor as capacitors charge.

(By P. C. J. Parsonage, in Wireless World.)

There's more to mid-range frequencies than meets the ear.

The graphic illustration below represents the typical frequency response expected in a good hi-fi system. A large proportion of the sound can be classified as mid-range and to hear this sound at its best a well engineered mid-range speaker is essential.

The new Plessey C6MR has been specifically designed to handle mid-range sound with excellent performance from 450 Hz to 6600 Hz and sharp roll off beyond these frequencies.

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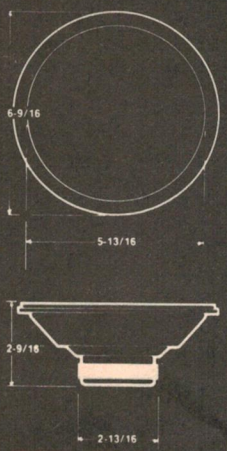

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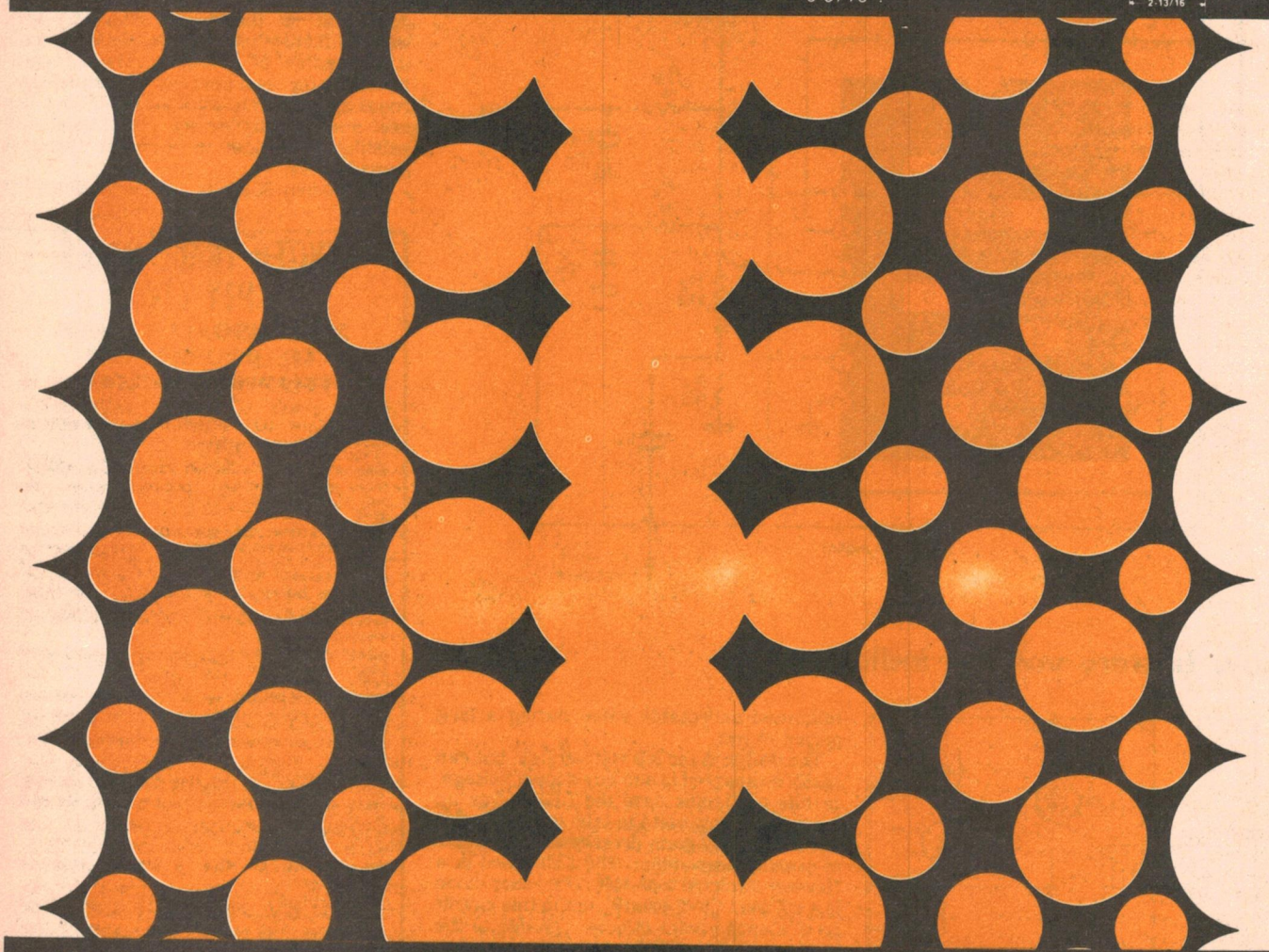

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Colour Television Systems

The colour camera. Filters and dichroic mirrors. Image registration problems. Four tube cameras. Three tubes cameras. "Contours from green" technique. Colour display systems. Three tube projection systems. Modulated light beams. The shadow mask tube. Operating principles. Method of construction. Limitations. Developments and improvements. The vertical aperture tube.

Having studied the basic aspects of colour and colour mixing in the last chapter, we are now in a position to discuss the optics and electronics of colour TV systems. However, it must be appreciated that the coverage we can give this subject, in a few chapters in a much broader course, must necessarily be limited. Nevertheless, we hope to give the reader at least a grounding in the subject; a basic understanding which will enable him to approach more advanced texts with confidence.

A logical place to start is with the colour TV camera. As implied in the previous chapter the basic requirement of such a device is to analyse the scene in the primary colours — red, blue and green — and generate separate signals representing each of these colours.

A fairly logical approach is to provide three camera tubes, one for each colour, and to split the incoming optical image so that it is directed to all three tubes. At the same time, the light must be filtered so that only the red rays are directed to the red signal tube, the blue rays to the blue tube and the green rays to the green tube.

One way in which this could be done is by means of prisms to split the light rays, with standard optical filters to provide the colour separation. Such a scheme will work, but the light losses incurred are relatively high.

In splitting the light rays a prism must obviously divide the available light between the outputs it provides, and at least one of these outputs must be divided again. On top of that, conventional filters introduce further losses. A red filter, for example, while passing the red rays, wastes the blue and green rays which it rejects. Thus we have the losses in two prisms and three filters, plus some deliberate losses which would have to be introduced to balance the light delivered to each tube. The overall loss would be quite high.

A much more practical approach is possible with an optical device called a dichroic mirror. Basically, a dichroic mirror is a sheet of optical glass on which has been deposited a very thin layer of transparent material having a refractive index different from that of the glass. The thickness of the coating is related to the wavelength of the light; typically one quarter wavelength of the light to be reflected. (The coating process is akin to that used for coating photographic lenses to minimise reflections.)

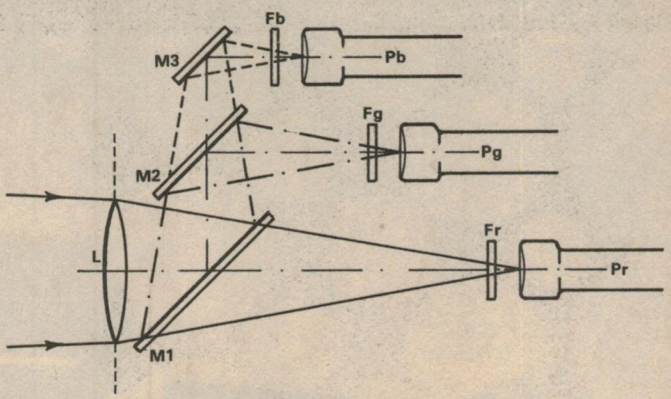
The effect of the dichroic mirror is to reflect a light of one colour and to pass the remaining light. Thus a red reflecting dichroic mirror would reflect red light, but pass the blue and green light. Similarly, a blue reflecting mirror will reflect the blue light and pass the remaining green light.

By arranging one each of these mirrors at 45 degrees to the light rays, the latter may first be split into red rays directed in one direction, and the blue and green in another. These rays may then be split again into blue in one direction and green in another.

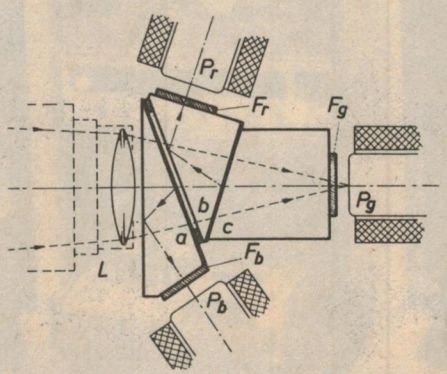
Thus, the dichroic mirror performs the dual function of beam splitting and colour separation. More importantly, it does this with almost no loss. The red mirror, for example, does not waste the blue and green rays it rejects, but simply diverts them for further use. Also, the splitting function does not introduce losses, as does the prism, since it is based on colour separation.

A further advantage of the dichroic mirror is that its response curve may be tailored quite precisely. In general terms the response is made sharper by depositing additional layers, having differing refractive indices, on top of one another. Mirrors used in TV cameras may have typically up to seven layers. Moderate filters may sometimes be used in addition, to provide small orders of correction in one or more channels.

This was the basis of the first colour cameras, a popular arrangement being three image orthicon camera tubes, plus the dichroic and surface silvered mirrors needed to direct the light rays to each tube, while retaining a reasonably compact layout. Nevertheless the complete camera was quite bulky.



Basic principle of colour separation using dichroic mirrors. M1 passes the red light and reflects the blue and the green. M2 reflects green and passes blue. M3 is a surface silvered mirror used simply to bend the blue light rays.



A more practical version of the dichroic mirror optical system, as used in modern TV cameras. All the elements are combined in a prism assembly which is more rigid, more compact, and sealed against dust. (From "Colour Television Explained" by courtesy of Philips Industries.)

Apart from size, these cameras suffer from a more serious disadvantage. To produce the equivalent of a monochrome signal, known as the luminance signal, the output of the three tubes is combined in suitable proportions. This is the signal which provides the fine detail in the final picture, whether it is presented in colour or monochrome.

Unless all three images are perfectly aligned, optically, the quality of the luminance signal will be seriously degraded. In practice, at the then state of the art, it was almost impossible to maintain perfect alignment, remembering that this is dependent not only on the mechanical stability of the optical system, but on the magnetic and electrical stability of the deflection yokes and deflection circuitry.

One solution to this problem was to provide four tubes, one exposed to unfiltered light rays and which provided the luminance signal, and the other three providing the red, blue and green signals as before. For this arrangement, a high quality image orthicon tube was customarily used for the luminance signal, with three much smaller tubes, such as Vidicons, used for the chrominance signals.

The fact that the image quality from the

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latter tubes is relatively poor is not much of a problem since, as we shall discuss in greater detail later, fine detail is not needed in the colour signals.

Eventually, this technique was also abandoned, in favour of a modified three tube concept. This is known as the "contours from green" techniqie.

In many ways this system is similar to the original three tube concept. It employs three Plumbicon type tubes, as originally developed by the Philips organisation. The outputs from these are mixed as before to produce the luminance signal. Registration problems have been minimised in several ways.

A major one is the progressive improvement, over the years, in the design of stable deflection systems. Another has been to build the dichroic mirrors into a compact prism. This not only protects the dichroic layers from dust, etc., but, by combining the optical elements into one unit, substantially improves the mechanical stability of the optical system. It also folds the light rays so as to permit a more compact tube layout.

Finally, the naturally "soft" (limited definition) characteristic of the Plumbicon helps to make registration marginally less critical.

The Plumbicon has a number of advantages for colour work, not the least being a linear transfer characteristic. But it also has some disadvantages, the most serious being the "soft" characteristic just mentioned, since it is essential to generate a high definition luminance signal.

This is where the "contours from green" technique comes in. A signal is taken from the green channel and, by various processes, including the use of delay lines, converted into a contour signal; a signal which portrays the boundaries of the image as a sharp line. This line or contour image is then fed back into all three channels, providing a sharp outline for all three colour images.

In theory, contours should really be derived from all three tubes, then fed back into their respective channels. In practice, the added complexity which this would involve is hard to justify, since the present system works so well. The reason the green tube is chosen is because green appears to be the most frequently encountered colour. It has been claimed that "there is a little bit of green in everything." While not strictly true, it is close enough for practical purposes.

Regardless of the type of camera, the output is the three colour signals plus the fourth, luminance, signal derived from either a fourth tube or suitable mixtures of the three colour tube outputs.

Complex though all the foregoing may sound, and in fact is, the production of a colour camera was probably the least difficult problem to be solved in developing a complete colour system. It did not call for any really new technologies or hardware; simply the careful application of existing ones already well understood.

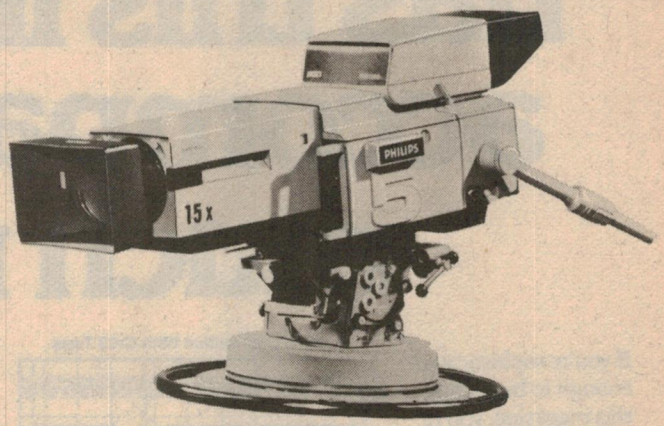
Such was not the case for the rest of the system. Engineers faced two major problems: how to get the colour signals from the camera to the receiver — without using a prohibitive amount of spectrum space — and how to display the colour image at the receiver. The first of these two problems, in particular, appeared to be an impossible requirement; yet it was solved. The second one, while not in the "impossible" class, might well have been described as "impracticable." Yet it, too, was solved.

At this stage it might be most profitable to consider the various display systems, even if the subject appears a little out of sequence.

One of the earliest systems, still used in special applications, employs three picture tubes, having red, green and blue phosphors respectively. The light output from these is then mixed in one of several ways to provide a composite three colour picture.

The most popular arrangement is to combine each tube with a Schmidt optical system and project the light from it onto a screen. The Schmidt optical system is a highly efficient arrangement using a reflector and correcting lens. Compared with the alternative, a conventional projection lens, it wastes much less light.

Even so, such a scheme is practical only in conjunction with specially developed, high intensity tubes, working at relatively high EHT voltages. Such systems can produce moderately bright images on small theatre type screens, but the available light is low compared with conventional motion picture systems.



A modern colour camera using three Plumbicon tubes and the "contours from green" technique explained in the text. The camera proper is quite compact, about half its length being a versatile zoom lens system.

The whole setup is quite complex and expensive, and normally requires technical supervision. It is useful in special applications, such as medical instruction, aircraft simulators and so on, but is far too expensive and complex for domestic use.

Other arrangements were suggested in the early days, one being three white phosphor tubes, with dichroic mirrors again providing colour separation, plus convergence of the three beams onto a small translucent screen.

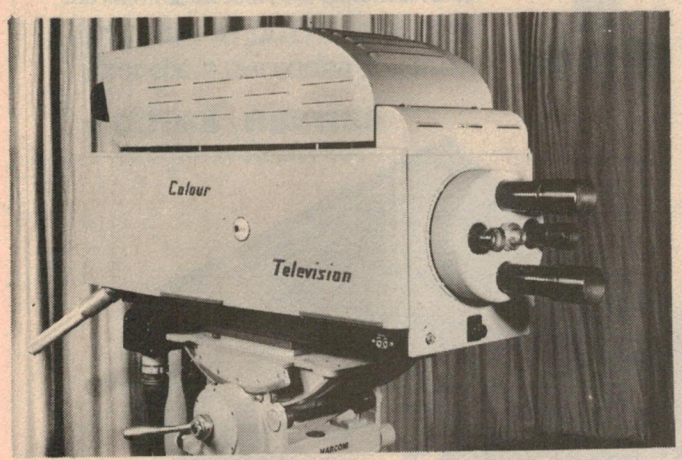
While a better approach at the domestic level, it was still an expensive and relatively clumsy method. It found little practical application.

A number of other projection systems have been suggested, and some tried with varying degrees of success. Most are based on primary light sources (high intensity lamp, arc, etc.) with suitable filters for the three primary colours. These are then modulated and deflected by one or other of several suggested schemes, most of which are quite complicated, and usually require technical supervision. The Ediphor system is one such and is very effective in a theatre type environment.

More recently, laser beams have been tried as the primary light source. These have the advantage that it is fairly easy to generate the required colours directly, and that the beam is naturally collimated, minimising the optical elements required. However, they do little to solve the basic problems of modulation and deflection, particularly the latter.

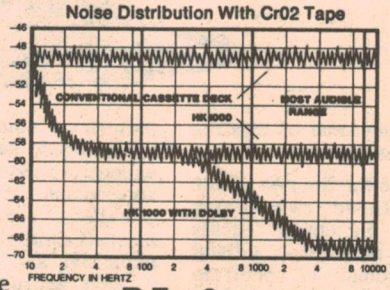
The real breakthrough in this part of the system was the development of the shadow mask type colour tube; a picture tube which generates the required colours directly on the fluorescent screen. An extremely complex device, its construction calls for a high degree of precision and its manufacture on a large scale has been described as one of the technological wonders of the 20th century.

Superficially, a colour tube looks much the same as a monochrome tube, except that it normally has a thicker neck and more base pins. Internally, however, it is much more complex. It is fitted with three guns, one for each of the three colours

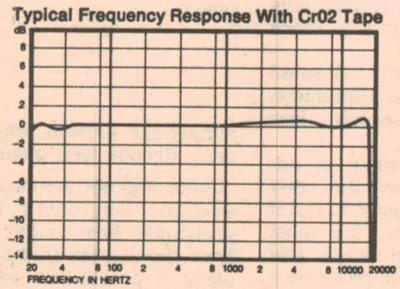


A much earlier colour camera, also a three tube type, produced about 1955. Although they were capable of first-class results, they were much larger than their modern counterparts. Note the lens turret, the zoom lens being less popular at that time.

Never before has this little noise accompanied this much music.



Noise.



Music.

If you're sophisticated enough to be reading this magazine, you're probably familiar with the two main characteristics of cassette decks: hiss and nonlinear frequency response.

Which should make you thoroughly unfamiliar with the performance capabilities of our new HK-1000. As the charts indicate, it behaves more like reel-to-reel than a cassette deck:

Signal-to-noise (unweighted) is −58 dB with Dolby and −70 dB in the audible hiss level above 4,000 Hz. The frequency response curve is essentially flat from less than 30 to beyond 15 kHz, ±1.5 dB, with CrO_2 tape. (This curve is due largely to the way we drive our heads. Instead of the conventional constant *voltage* drive to the head, the HK-1000 is designed for constant *current* drive. Many studio model reel-to-reel decks are designed the same way.)

Because of a new low in noise and a new wide in frequency, the HK-1000 brings you a new clarity in music.

Ours is the first cassette deck designed for maximum phase linearity. Square wave response is better than every other cassette deck and even some expensive reel-to-reel decks. And the better the square waves, the cleaner and more transparent the music.

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The HK-1000 is also designed so you can use it often without endangering it. Plug-in printed circuit boards are used for simplicity and reliability of operation. Heads are easy to reach and clean. And the transport is the most reliable we've ever tested; it even closes with the sort of reassuring "thunk" you normally hear only by closing the doors of expensive hand-built cars.

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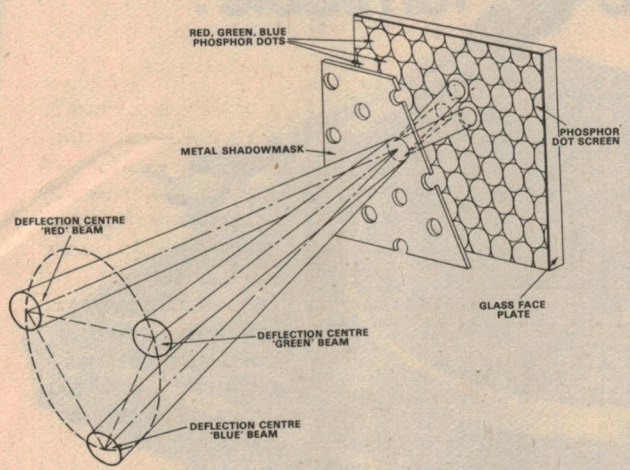
(hence the thicker neck) and a screen made up from a very large number of small phosphor dots. These dots are in groups of three, called a triad, one for each of the three colours. Each group of dots forms a triangular pattern, and this tube is sometimes called a "delta" type.

Fairly obviously, these dots must be quite small; too small to be resolved individually by the eye at a normal viewing distance. Typical dot size is about 0.4mm diameter and they are about 0.7mm apart. On the face of a typical colour tube there would be over 400,000 triads, or three times this number of individual dots. The production of such a screen, in itself, is major technological achievement.

But the really difficult part is yet to come. While the three electron guns will produce electron beams, one of each of the three colours, and the phosphor dots will produce the required colour when the particular electron beam strikes them, some mechanism must be provided whereby the red electron gun can only ever energise the red dots, the blue gun the blue dots, and the green gun the green dots.



This diagram shows clearly how the shadow mask picture tube functions. The three beams meet at the shadow mask, then diverge to energise their own individual dots on the faceplate. In practice the beams are larger than the holes and some beam energy is wasted.

This is the job for the shadow mask. The shadow mask is a thin mild steel plate (about 0.15mm) located about 10mm behind the fluorescent screen. It carries a pattern of tiny holes, one hole for each group of three phosphor dots.

The three guns are arranged in a triangular pattern, exactly matching the triangular pattern of the triads. The mechanical and electrical parameters of the tube are so arranged that the three electron beams converge at the shadow mask. Where they converge on a hole, they will diverge as they emerge from the other side of the hole, reforming into three separate beams.

Each beam will now fall on the dot corresponding to its colour designation. More importantly, it can never fall on any other colour dot. As the beam is deflected, it moves from hole to hole, energising the triad belonging to each hole in turn. In practice, the converging beams may cover three or four holes at a time, but in each case the individual beams are directed to their appropriate dots.

This arrangement is quite effective, but it is not very efficient. Something like 80pc of each electron beam strikes the shadow mask, with only about 20pc finding its way through the hole to the screen. As a result, colour tubes need a much higher EHT current than monochrome types and, even so, do not always achieve the same brilliance. However, a number of recent developments, which we will discuss later, have improved this situation markedly.

The reader might fairly ask how such a tube is manufactured, and particularly how the precise alignment can be achieved between the electron guns, the shadow mask holes, and the triads, such that the beams always strike the correct dots.

The method is quite ingenious. The shadow mask is made first, the holes being etched by a refined version of conventional photo-etching techniques. After etching it is pressed into a slightly spherical form, to match the curvature of the tube face plate.

Next the mask is fitted to a blank faceplate, ie, one which as yet has no phosphor coating. Then a phosphor coating in one of the colours is applied, the phosphor being mixed with, among other things, a photo-resist similar to that used for other forms of photo-etching, such as the manufacture of printed wiring boards.

The faceplate assembly is fitted to a jig which carries three light sources very carefully positioned. They are in fact positioned at those points where, in the finished tube, each electron beam will be deflected, ie, at approximately the position where the tube neck begins to flare out into the body. (These points are known as colour centres.)

Assuming that the green phosphor has been laid down first, the light source corresponding to the deflection point of the green electron beam will be energised first. The light from it will shine through the holes in the mask and, where it shines on the photo-resist, will cause the latter to harden.

When this process is complete the phosphor is washed away — using a suitable solvent — except where it has been hardened by the light. So there has been laid down a pattern of green dots, each one exactly where it can be seen from the position where the green beam will be deflected.

Then a second phosphor is applied, say the red, the light source representing the red beam turned on and, after hardening, the surplus red phosphor washed away. The same procedure is used for the blue phosphor.

Thus we produce an individual faceplate / shadow mask combination which is unique; no other similar combination will be exactly the same. These are ultimately assembled into a complete tube.

As we have already intimated, the shadow mask tube is not a very efficient device, a significant proportion of the electron beams striking the shadow mask rather than the phosphor dots. This makes necessary a heavier beam current which, together with the thicker neck, substantially increases the energy necessary to deflect the beam.

In the last few years a number of improvements have helped reduce these problems. One was the development of a much higher efficiency red phosphor. Originally, the red phosphor was markedly lower in efficiency than the other two, meaning the output of the latter had to be limited artificially to maintain colour balance. The new red phosphor allows all three phosphors to operate close to the maximum efficiency.

Another trick was to provide a black surround for the dot pattern, filling the otherwise unused areas of the screen with black. This can amount to nearly 50pc of the screen area and the black effectively darkens the tube face under ambient light conditions. This is so effective that the neutral density filter normally required can be either eliminated or modified considerably, thus allowing a much brighter image to be presented to the viewer.

The black surround technique has also permitted the holes in the shadow mask to be enlarged, without the risk of spillover from any one beam to an adjacent colour dot, thereby further improving efficiency.

The problems of beam deflection have been tackled in two ways. What might be termed broadly as the "European" approach is to develop more effective deflection circuitry, and leave the tube more or less "as is."

What might be termed the "American" approach seeks to improve the tube so that deflection is easier. The most notable improvement has been to reduce the diameter of the gun structure and the tube neck, thus reducing the distance between the deflection coils and the electron beams.

A shadow mask at the inspection stage. The pattern of tiny holes is so fine as to make the mask appear semi-transparent.

Earlier we mentioned the colour centres; the points occupied by the exposing lamps when the phosphor dots are laid down. The points from which the beams are deflected when the tube is in use are called the deflection centres and it is fairly obvious that the colour centres and the deflection centres should coincide. If they do not, individual beams will strike dots other than their own, creating an impure colour. Adjustments to correct this are called purity adjustments.

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One such adjustment involves sliding the deflection yoke along the neck of the tube, moving the deflection centres backwards or forwards until they occupy the same plane as the colour centres. Provision is also made to rotate the beams slightly around the axis of the tube, and to expand them outwards from, or inwards to, the tube axis until, again, they coincide with the colour centres. These adjustments are provided by two circular magnets mounted around the neck of the tube. The magnets may be rotated relative to one another, or as a pair. Properly adjusted they will position each beam on its own colour centre.

Another problem inherent in this type of picture tube is that of convergence; the need to ensure that the image outlines produced by each of the three beams exactly coincide.

The nature of the problem may be better understood by considering a conventional projector and screen setup. A normal requirement is that the projector lens axis must be coincident with a line perpendicular to the centre of the screen. If not, a normally rectangular image will be distorted into a trapezoid.

In practice, a modest amount of error may not be noticed but, if we attempted to superimpose three identical images, from three separate projectors, we would find that even a small amount of trapezium distortion would be quite intolerable.

This is exactly the situation with a three gun tube. At best only one gun could occupy the correct position and in practice none of them does. One, normally the blue gun, comes closest, being correct in the vertical plane.

To overcome this it is necessary to provide dynamic correction for each beam, using specially shaped waveforms generated from the horizontal and vertical deflection waveforms. These are applied to three correction units, one for each gun, located behind the yoke. Each unit consists of two coils, one being fed with vertical correction signals, the other horizontal correction signals.

This necessarily brief description will give the reader some idea of just how complex is the convergence problem, and the correction procedures necessary. Together with the purity adjustments previously described, they add up to a lengthy and complex setting up procedure which, because it requires a skilled technician, is also quite expensive.

These adjustments are required at least once for each new set, ideally in the customer's home with the set in the position it is to occupy. This is because the earth's magnetic field can upset these adjustments if the set is moved to a new position.

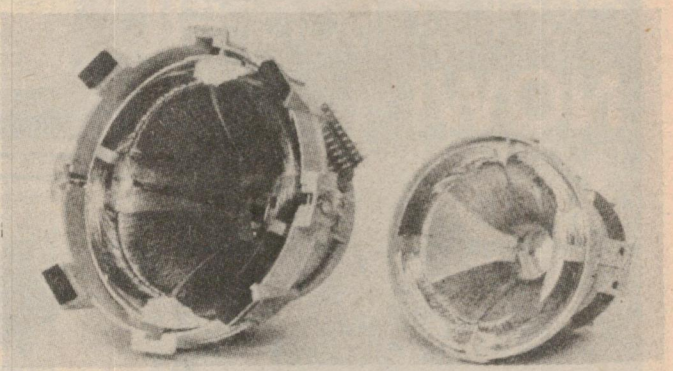
Some protection is provided against this by enclosing the bulk of the picture tube in a magnetic shield made from mild steel sheet. This is not a complete answer because the shield itself, as well as other ferrous metals located near the tube can become magnetised by stray magnetic fields set up by domestic appliances, magnetic toys, etc, which may be brought into close proximity to the set.

To guard against this the shield is fitted with an automatic degaussing coil. This is activated every time the receiver is switched on, being fed with AC at mains frequency, initially at a high level, tapering off to virtually zero in a few seconds.

Obviously the purity and convergence adjustments have to be repeated if a new tube has to be fitted, adding further to the already high cost of this item. They may also have to be repeated on other occasions, where service involves disturbance or replacement of any of the deflection or correction components.

In summary then, the delta type colour tube, while being a most ingenious solution to a very difficult problem, is also a highly complex device, requiring a lot of ancillary equipment and a host of complex adjustments to make it work correctly. Along with the high price of the tube itself, these requirements create an economic barrier which severely reduces the popularity of colour TV sets.

A major advance in colour tube design was the appearance, in 1968, of a tube called the Trinitron, developed by engineers of the Japanese Sony Corporation. The word Trinitron is a trade name and the generic term now being adopted is "vertical aperture tube," or "slotted aperture tube."



A deflection yoke for the Trinitron tube is shown on the right, compared with a yoke for a conventional delta tube (left). Not shown are the extra convergence coils needed with the delta tube.

The Trinitron is still a shadow mask tube, and operates on the same broad principles but differs in a number of significant respects. The most obvious difference is the pattern of colour phosphors on the screen. Instead of triangular dot patterns they are arranged in thin vertical stripes, each stripe being comparable in width to the diameter of a dot. To suit this the shadow mask pattern is a series of vertical slits, one for each group of three phosphor stripes.

The stripe pattern is no less effective than the dot pattern, and has a number of advantages. One of the most important is that the shadow mask is some 30pc more transparent to the electron beams than its dot type counterpart. Since lack of brightness has always been a colour tube problem, this is a most valuable feature.

Just as important is the fact that the vertical pattern concept makes possible a number of valuable improvements in the gun structure and deflection system. Whereas the delta type tube employs three cathodes and three separate guns, the vertical aperture type employs three cathodes but only a single gun. In addition, the cathodes are arranged "in line" in the horizontal plane, instead of the triangular pattern.

These changes bring about a number of advantages. One is that the single gun makes possible a smaller tube neck while, at the same time, the single gun is much larger than the individual guns used in the delta type tube. This permits a heavier beam current and a still further increase in light output. The total light increase is something like two to one and, in practice, puts the colour tube virtually on a par with monochrome tubes.

The smaller neck also reduces the power needed to deflect the beam, making possible a smaller deflection yoke and simplifying some deflection circuit requirements.

But probably the greatest single advantage concerns the convergence problem. As already explained, the convergence problems in the delta type tube are due mainly to the use of three guns, with three electron streams emanating from three different positions in space.

By comparison, the single gun of the vertical aperture tube uses only a single electron lens and the three beams emanate, in effect, from the same point in space. The result is virtual elimination of trapezium distortion, and the complex correction procedures which it makes necessary.

The practical result of all this is very significant. Whereas convergence for a delta tube would typically involve 12 or more separate adjustments, with the extra circuitry and hardware which this implies, the vertical aperture tube reduces this to about four, with an appropriate reduction in correction circuitry and hardware. This, in turn, means a substantial saving in production and service costs.

(For a fuller description of the Trinitron tube see "Electronics Australia," April 1972, pp22.)

The RCA Corporation in America has recently developed its own version of the vertical aperture tube, incorporating a number of worthwhile improvements. One of these is a modification to the shadowmask, aimed at making its structure more rigid and permitting it to be curved to suit the faceplate of the larger types.

The most important improvement is probably that associated with the convergence problem. The new design appears to achieve the ultimate solution, in that it requires no convergence adjustments of any kind.

Part of their solution is a new yoke design which is, at the one time, simpler to produce, uses less copper wire, and achieves a high degree of accuracy in mass production. The other part of the trick is to cement this yoke permanently to the neck of the tube.

The result, from the set manufacturer's point of view, is that he buys the tube and yoke as a single unit which requires no convergence adjustment. This reduces manufacturing costs quite significantly.

(Ref "Electronics Australia," September 1972, p9.)

While, initially, the vertical aperture tube was confined to the smaller sizes (typically 28cm diagonal), size has been progressively increased and they are currently being made and marketed up to 51cm, with prototypes of 66cm having been demonstrated. Deflection angle is normally 110 degrees for the larger sizes.

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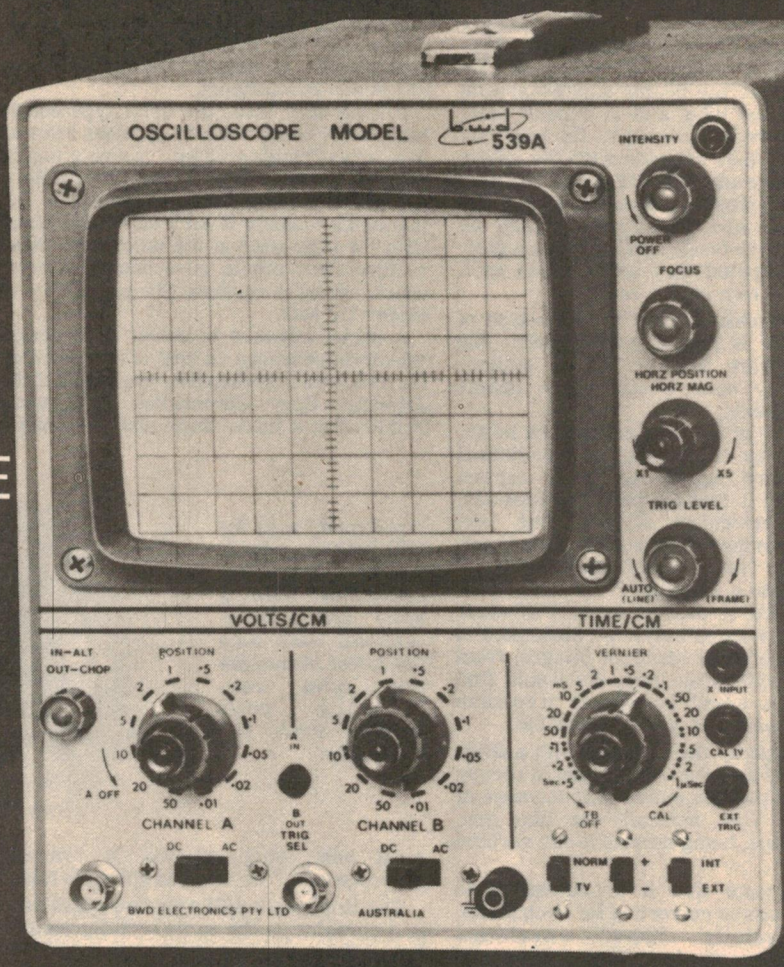

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Let's talk about amplifiers

Elementary Electronics

by Ross Tester

In the last two issues we have been talking about crystal sets; radio frequencies, tuned circuits, detectors etc. Now, for a change, we are going to concentrate on audio frequencies and the devices used to process them: audio amplifiers.

Many of our readers, particularly the older ones, may be already familiar with valve amplifying configurations but are confused when confronted with the transistor equivalents, either on paper or as hardware. One of the best ways to break this barrier is to first study the basic principles of the circuitry, then grab a soldering iron and the necessary bits and pieces and get to grips with it at a practical level. Make up the simple circuit we will describe and learn how it works.

In valve technology there are three basic amplifier configurations: the common cathode; the common plate, more usually called the cathode follower; and the common grid, more usually called the grounded grid.

The solid state equivalents are: the common emitter; the common collector, more usually called the emitter follower; and the common base. (Fig. 1)

Their names come from the fact that each type has one element (collector, base or emitter) common to both input and output. This is an easy way to remember each type. We also used the term "emitter follower". This is the more common name for the common collector type, chosen because the output signal at the emitter follows very closely the signal applied to the base — both in phase and amplitude.

From now on we will use the term "emitter follower," as this is the one you will invariably meet in practice.

The common emitter amplifier is probably the most widely used of all amplifiers. Its main feature is a high order of gain — typical circuits may give voltage gains of 40-180 times, which compares very favourably with thermionic circuits. Similar current gain figures are obtainable. The power gain, being the product of voltage and current gains, is high — of the order of 10,000 or more.

The input impedance of a common emitter amplifier is naturally low to medium. However, by choice of components in the bias network, this impedance can be varied. Depending on the bias and the device itself, common emitter input impedance may be anywhere from a few ohms to a few hundred kilohms.

In audio circuits, the input impedance will generally be at least a few thousand ohms — probably more. Specialised circuits, such as RF, have lower impedances.

The output impedance is approximately equal to the collector load resistor, which is usually fairly low — say 50 kilohms or so. This, too is variable. Actually, the impedance is equal to this resistor in parallel with the device output impedance but, because the device impedance is usually very much higher, it can be disregarded.

The signal at the collector is 180 degrees out of phase with the signal at the base. This means that if a sine wave were applied to the base, it would appear inverted at the collector. This is not particularly important at this stage — but we mention it as a similarity between this and the common cathode type.

The emitter follower configuration is another very common circuit. It has wide uses, ranging from power amplifier stages to simple buffers and impedance "transformers".

The voltage gain of the emitter follower is always less than unity. For very high gain transistors it may approach unity, but can never equal or exceed it.

The current gain of the emitter follower is high — often 100 or more. The power gain will be slightly less than the current gain.

The natural input impedance is very high but it can be tailored to suit the circuit. It is mainly dependent on the bias network resistance which can be arranged to have high (2-3 megohms or more) resistance for silicon devices or lower (few hundred kilohms) in the case of germanium types.

The output impedance is low, making the configuration ideal for output stages which can work directly into low impedance speaker voice coils without the need for a speaker transformer. It is also useful where any high impedance has to be matched to a low impedance and is often used in lieu of a transformer.

The output impedance is determined by the output resistance of the device itself in parallel with the emitter resistor. The device output resistance is generally much lower than the emitter resistor.

The emitter follower does not invert the signal; rather, the emitter follows the input. It is also capable of handling large input signals without overloading.

The common base configuration is not used widely in audio circuits, except where a very low input impedance is required. Its other use is confined mainly to VHF applications (for reasons which are a little involved to go into here) and as part of transistor-transistor-logic (TTL) integrated circuits.

The common base can be arranged to give high voltage gains, but the current gain is less than unity (the exact opposite to the emitter follower). Therefore, power gains are not high — generally somewhere between that of the emitter follower and the common emitter configurations.

The input resistance is very low, being equal to the emitter resistor in parallel with the B-E junction resistance. This makes it suitable for an audio preamplifier, operating from a low impedance signal source; such as a speaker used as a microphone. (Ideas Worth Trying, April 1972).

The output impedance is roughly equal to the collector resistor. Like the emitter follower, the common base configuration does not alter the signal phase between input and output.

This month, we plan to look more closely at the common emitter amplifier. Later, (perhaps next month) we will look at the emitter follower.

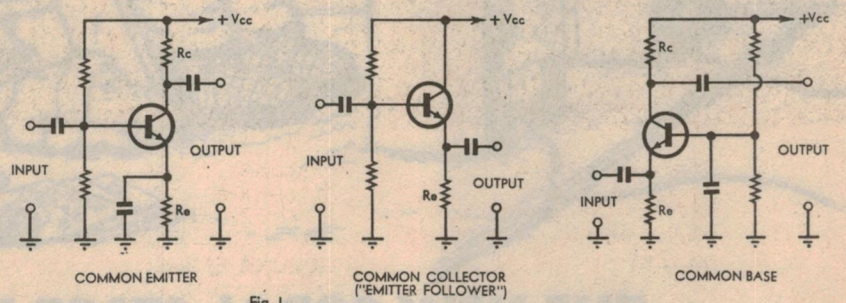


Fig 1

The three basic transistor amplifier configurations; common emitter, common collector (more usually known as the emitter follower), and common base. The first two are particularly important in audio circuits, as discussed in the text.

The common base amplifier applications are rather more limited, so we will leave this one for the present.

Coming to the practical side, how does one go about building even a simple amplifier? More particularly, how does one select a suitable circuit?

There are several possible approaches. One can simply take a published circuit, copy it parrot fashion, and hope that it works when it is switched on. At the other extreme, one can collect all the available data and texts on the subject and attempt to design a circuit from scratch.

Neither is a good approach for the beginner. The first is too easy and teaches

little or nothing about how the thing works. The second will almost certainly prove too hard, with consequent discouragement. The best idea seems to be to work from a published design, but one which explains at least the general factors which govern the selection of component values.

Armed with this information the reader can (1) make an intelligent approach to the problem in the event that the project does not operate correctly when first switched on and (2) experiment intelligently in the event that the chosen circuit is not exactly suited to the application in mind.

This is the aim of this article. We are going to describe how to build a simple amplifier to go with the crystal sets we described last month and, in the process, tell you something about how it works and why the various component values are as they are.

One of the first things any experimenter should do is arm himself with as many transistor data sheets or books as he can find. These are normally made available by the manufacturers, sometimes as simple sheets, issued gratis, and sometimes as quite comprehensive books costing a few dollars. Money spent on these will be a sound investment.

These data sheets supply such information as the type of transistor (germanium or silicon), its general application (amplifier, power output, etc), its polarity (NPN or PNP), together with its ratings such as maximum voltage, maximum current, maximum dissipation, its gain (Beta or hFE).

They will also provide the lead connections. This is important because there is much variation from the nominal "standards", making the identification of some transistor connections difficult. Fortunately, most transistors do follow a standard, but there are some traps for young players.

Take, for example, a recently introduced transistor in a T092 silicone package. Two manufacturers (Fairchild and Philips) have near identical transistors in this package — identical electrically as well as physically. However, in one package the leads are oriented one way — E,B,C, — while in the other package, looking at the pins the same way, the configuration is C,B,E. Frustrating, isn't it?

Therefore, if possible, find a reference to the connections. You may have noticed we publish transistor connections along with our circuit diagrams for each project. These will assist in finding the connections for most of the common types.

We have also shown a diagram with most of the common transistor connections. Where doubt may exist, types are given.

Now let us consider a practical amplifier (Fig. 2). While we could make an involved type, with high performance, we decided a better place to start would be a simple single stage amplifier, capable of amplifying, say the signals obtained from the crystal sets of the previous two months.

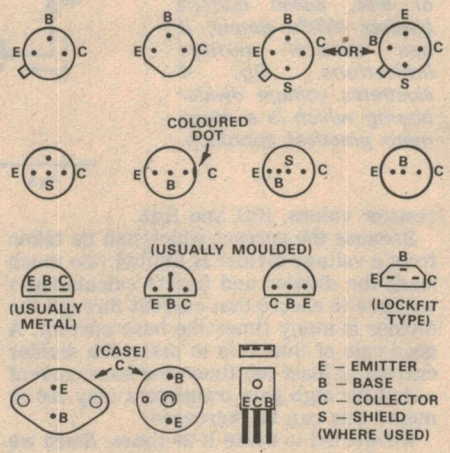
To save money, we have used the speaker transformer from the Twin Tune set described last month. In fact, we have based our construction on this set.

The first question in designing this (or any) amplifier must be, "Where do we start?"

The place we started was the load — a 5000 ohm speaker transformer. However, there were a few other items to be decided on before we could proceed any further. One was the supply voltage.

For convenience (and economy) we nominated a 9 volt supply — small 9 volt batteries are relatively cheap. The transistor was an NPN, silicon, general purpose type, with a reasonably high beta. Providing any transistors you have on hand meet these general specifications, they could be used.

The transistors are not power types, though they are being used in a "power output" role. Power types, as a rule, have low current gains (betas); usually less than



The most popular transistor connections are shown here but these should be backed up by manufacturers' data sheets.

200. The types we are using have betas of at least 200 — some go as high as 900. While we have used an NPN type, this does not preclude the use of a PNP — if you have a high gain silicon PNP (such as a 2N3638A) by all means use it, but do not forget to reverse the battery and polarised capacitors.

The potentiometer is optional, being required only in strong signal locations. It can be replaced by a 10k resistor, shunted by the .001uf capacitor, with the output taken directly from the diode.

The input capacitor is shown as 0.1uF which is about the smallest which can be used in a simple application of this kind. Larger values can be used and will give some improvement in low frequency response.

In designing the amplifier, we assume the transistor will "swing" over the range between cut-off and saturation. It will not swing this far in practice — distorition would occur if it did — but it makes the job easier if we make certain assumptions.

Because our load impedance is 5000 ohms, and the supply is 9 volts, the most current which can flow through the load is 1.8mA, occurring when the transistor is saturated. The least current would be zero, when the transistor is cut off.

To obtain the maximum "swing" in the load, the current should ideally vary up and down from the midpoint between 1.8mA and 0mA — or 0.9mA. By providing this value of "quiescent" current, any AC input to the base circuit will make the transistor conduct slightly more or slightly less — resulting in collector current varying in unison.

This current must flow through the primary of the transformer — and whenever there is a change in current, the secondary winding will receive this by transformer action. This operates the headphones. Note that the quiescent current will not produce secondary output. It is only when a change occurs that this can happen.

To make the job easier, we can assume the maximum saturation current to be 2mA (instead of 1.8mA) and the half-current (quiescent) 1mA — a much easier figure to work with.

Now we can consider the base circuit. Logically, the transistor needs to be biased on if it is to work. This bias must set the collector current at the chosen figure of 1mA.

There are two main methods of biasing. The first is called current biasing — see Fig. 3. A single resistor, Rb, is used to bias the transistor from the supply line. The value of this resistor is determined by two formulas — one being Ohm's law, and the other probably the most-used formula in solid state design. It says that base current will be equal to the collector current divided by the current gain (beta) of the transistor.

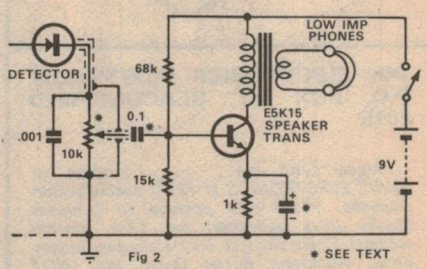
Expressed as a formula,

$$Ic = B \times Ib$$

where Ic is collector current, B is beta and Ib is base current. Learn this formula — it will come in very handy.

This formula, plus Ohm's law, gives us the value of the resistor. The collector current, which we talked about earlier, has been decided as 1mA. The beta of the transistor may be from 200 to 800 for a BC109 (which we used) but the minimum figure is always taken, so we use the figure of 200. It is safe enough to assume this beta for most of the common "audio" general purpose transistors.

Therefore, base current will be equal to 5uA. From Ohm's law, the resistor value will be equal to the voltage across it (8.4V — supply voltage less the drop across the B-E junction) divided by the current through it.



Complete circuit of a simple amplifier to suit the crystal sets described last month. Its design is discussed in the text.

Therefore, this resistor should be 1.7M. Simple, isn't it?

Yes — too simple. This type of biasing, while used in some applications, has a number of serious disadvantages. The worst is that it is very dependent on the beta of the individual transistor (no two transistors will have the same beta — even of the same type number) and it has no inherent protection against changes in temperature.

There is another biasing system which, for practical purposes, overcomes these problems. This is "voltage divider" biasing, illustrated in Fig. 4. The bias network consists of three resistors: Rd1, Rd2, and Re. As before, these resistor values can be calculated using Ohm's law and the current

gain formula.

We have already established that we require a quiescent current of 1mA. Resistor Re is calculated from this figure on the basis that it is required to develop a small voltage across it which, within certain limits, can be selected arbitarily. The main requirement is that this voltage be small relative to the supply voltage. In a case like this a convenient value would be 1V but, whatever value we select, it will be taken into consideration in the next step.

This is to calculate the voltage divider resistor values, Rd1 and Rd2.

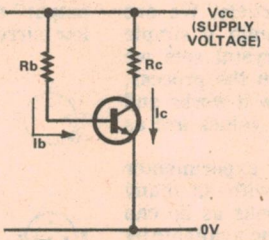


Fig 3

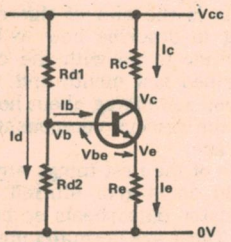


Fig 4

Fig. 3. The simplest form of bias, called current biasing. While simple, it has several serious limitations. Fig. 4 illustrates voltage divider biasing which is a much more practical approach.

Because the current which can be taken from a voltage divider is limited (too much loads the divider and upsets calculations) we have to ensure that current through the divider is many times the base current. A good rule of thumb is to make the divider current at least ten times the base current — but for high gain transistors (say 200 or more) this can be increased.

We elected to make it 20 times. Since we have already worked out our base current as 5uA, this makes our divider current 100uA. Thus we calculate a resistor which will pass 100uA at 9V; which works out at 90k. We now have to break this into two resistor values to provide the correct voltage at the base of the transistor.

We have already established that there will be 1V at the emitter and, as it requires at least 0.6V to turn on a (silicon) transistor, the base must be elevated to at least 1.6V above the negative supply line. At 100uA this sets Rd2 at a calculated 16k, or the closest preferred value, 15k. Resistor Rd1 will be 90k (total resistance) less 15k, or 74k. We used the nearest preferred value, 68k.

Operation of this network is largely self balancing. The voltage across Re is, in effect, a "bucking" voltage which opposes the voltage generated by Rd1 and Rd2. Thus, with 1V across Re and 1.6V across Rd2, the 1V of Re is subtracted from the 1.6V of Rd1 to produce a value of 0.6V between the base and the emitter. Thus, if the voltage across Re increases the base-emitter voltage, or forward bias, will decrease.

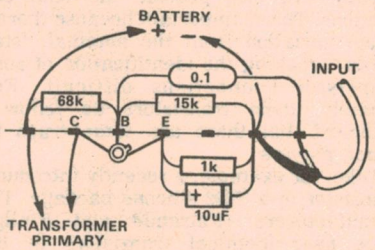
The only way in which the voltage across Re can increase is by an increase in collector current. But should this happen (or tend to happen) the immediate result will be a reduction in forward bias, which will reduce the collector current, thus tending to re-balance the system. Similarly, the reverse applies for any tendency to reduced collector current.

While voltage divider biasing has a number of advantages over current biasing, it has one disadvantage. The introduction of a resistor into the emitter circuit has an unfortunate side effect — that of reducing gain quite considerably.

Because the signal across the emitter resistor is proportional to the collector current (that is, proportional to the voltage across the collector load) and the input signal voltage is applied between the base and the negative supply, any signal voltage appearing across the emitter resistor will be subtracted from the input signal voltage, thus reducing gain.

However, just as easily as we lost the gain, we can get it back. All we need do is make the emitter resistor "blind" to the AC signal, while maintaining the DC bias voltage. To do this, we "bypass" the emitter resistor with a capacitor. This capacitor must have a low impedance at audio frequencies, so at least a few microfarads is required. We used a 10uF, 6VW — but this component, of all in the amplifier, is probably the least critical. Probably anything from, say, 1uF to 50uF or more would be quite satisfactory.

Earlier, we hinted at the need for protection against temperature changes. This is important because an unprotected transistor can go into a condition called "thermal runaway" and bias itself into saturation. At the least this will seriously upset the operating conditions and, in extreme cases (but unlikely in this circuit) can destroy itself.



Wiring diagram showing how the amplifier in Fig. 2 may be wired on a tag strip.

Increase in temperature can increase the collector current, the beta, and the leakage, and reduce the base-emitter junction voltage. In a simple circuit like Fig. 3 an increase in temperature would increase the collector current, which would increase the power dissipated by the transistor, which would increase the temperature . . . which is where we came in.

In some amplifiers, "thermistors" are used to counteract heat rises. In other amplifiers, devices with opposite temperature characteristics are used to balance each other.

The biasing system of Fig. 4 provides an adequate order of protection for simple circuits of this kind. As we have already explained, any tendency for the collector current to increase — in this case due to temperature rise — will produce a decrease in forward bias to counter this tendency. Thus the voltage divider biasing system not only accommodates the quite wide spread of characteristics from one transistor to another, but also provides the necessary temperature compensations.

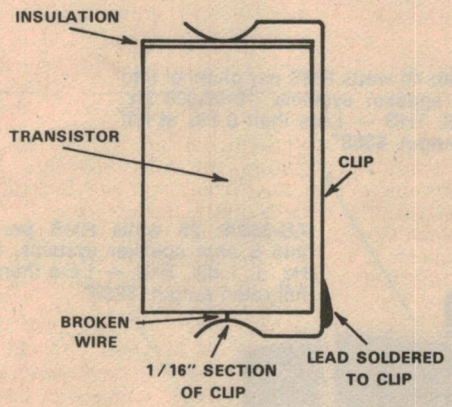
Elementary Electronics Ideas Worth Trying

Transistor Repair

Following the suggestion in the September 1973 issue on repairing a broken transistor lead, here is another reader's idea. As with the previous one we must emphasise that the long term reliability of such a repair may by doubtful, but may be fully justified at an experimental level. Our contributor writes:

When transistor leads break off flush with the bottom of the transistor, they can usually be repaired by means of a small clip, made from a piece of tinplate.

With a pair of tinsnips cut a small strip from the lid of an empty food can. Cut it about 3mm wide and 25mm long, depending on the height of the transistor. Trim the last couple of millimetres down to about 1mm or 1.5mm wide.



Bend the strip of tinplate as shown in the diagram, starting from the thin end which presses onto the broken lead. The other end may need to be shaped to suit transistors with curved tops. Cut off surplus tinplate.

It may be necessary to insulate the clip from the body in the case of metal cased transistors. This can be done with a single layer of insulation tape.

A lead is soldered to the clip and the clip fitted. Finally, glue may be applied to the top and bottom of the clip. This makes the repair quite sturdy. More than one clip may be fitted if necessary, providing they are insulated from each other.

Although the transistor is less compact, it is still suitable for experimental work.

(Mr A. Drummond, 78 Glenhaven Rd, Glenhaven, 2154.)

Storing Wire

When salvaging wire from an old transformer, speaker field etc, or when making up a portable antenna, there is a need for something convenient on which to store the wire.

Faced with such a problem recently I unearthed an old fishing reel. This proved to be ideal for the job. Made of plastic, it will accommodate several hundred feet of wire and this is easily unwound when wanted.

Amateurs who like to carry a pre-cut HF antenna on holidays or to field days, should find this arrangement particularly convenient.

(Mr N. Trupp, 1/27 McBride St, Heatley, 4814.)

Third Hand

I have noticed a lot of suggestions in your magazine and others for various kinds of "third hand" to hold small components while soldering etc.

A common idea is to mount an alligator clip on a block of wood. I tried this but it was not entirely suitable in my case. As an alternative I mounted the alligator clip on a rubber suction cup. With this I can hold the work on the bench, or on a wall, without it slipping about.

(Mr P. Stacey, "Cooinda", Merriwa, 2329.)

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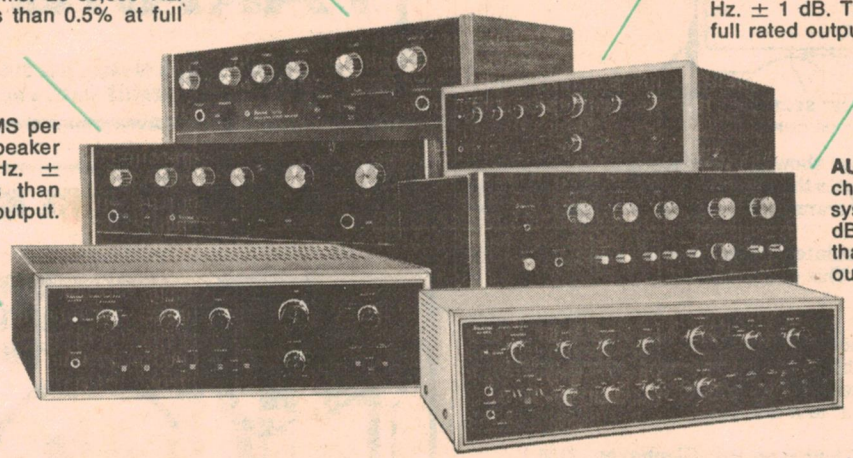

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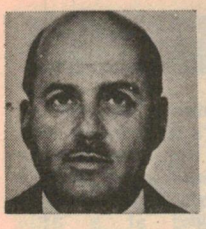


CLASSICAL RECORDINGS

Reviewed by Paul Frolich

Shostakovitch — Symphony No. 13 — "Babi Yar"

SHOSTAKOVITCH — Symphony No 13 "Babi Yar". Artur Eizen, bass; RSFSR Academic Russian Choir; Moscow Philharmonic Orchestra, conductor Kiril Kondrashin. HMV Melodiya stereo-ASD 2893.

Shostakovitch's 13th symphony, opus 113 in B flat minor, to texts by Yevgeny Yevtushenko, first performed in 1962 . . . It is not properly a subject for the record reviewer, or even for the music critic; to do it proper justice would, I think, require the services of a musically trained social historian and political scientist. Forgive me, please, if I am not truly equal to the task!

Shostakovitch has not been a timid violet, by any means, but compared to the determinedly controversial poet Yevtushenko, he is an ivory-tower type. And, lest anyone remain in doubt about the co-authors' readiness to face both controversy and official disapproval, the first poem, "Babi Yar", is a choice none could misunderstand. Babi Yar is the name of a village where the Nazi invaders massacred hundreds of Jews and many Russian prisoners, near Kiev. Anti-semitism has been a touchy subject in Russia for many decades and is so now.

Whatever the political implications — and I suspect that there are many more than a simple music-lover could hope to fathom — this symphony is a magnificent work. After its 1962 premiere, when it was enthusiastically received by Moscow audiences, but not reviewed in Pravda, it lay dormant until 1965. In that year, Kondrashin performed and recorded the piece and a pirated edition was issued on the Everest label in the West. Then, Ormandy received a copy of the score from an anonymous source in 1969; he was fascinated and played and recorded the symphony in 1970.

Both Kondrashin's first version and Ormandy's won acclaim, but it is now apparent that neither did the music full justice. It is powerful music, bitter and accusing — it has quite a lot in common with Britten's "War Requiem". More importantly, this is highly personal music; it is the first of Shostakovitch's major works that makes me feel I know something about the man and the artist behind the work. The music is powerful, deeply moving, yet easily appreciated.

The symphony is in five movements, the last three of which, on side 2, are continuous. "Babi Yar" (Adagio) is followed by the intensely rhythmic and exhilarating "Humour" (Allegretto). The remaining movements are the slow "In the Store" (homage to queuing Russian women), "Fears" and the satirical "Careers". Yevtushenko's poetic power, to judge from the accompanying texts, is not always in top-gear but never less than adequate as the composer's inspiration.

The music, as I have indicated, is very powerful, often beautiful, written with utter skill and care. The recorded performance must, I think, be accepted as the definitive version. Kondrashin is wholly in command and yet totally absorbed in the score. The playing of the orchestra is superb even if, in details, probably not superior to Ormandy's. Eizen, a bass in the grand Russian tradition, cannot be faulted and the recorded sound, harsh and opulent in turn, all anyone could reasonably ask for. This is a disc to be treasured.

★ ★ ★

MOZART — "La Finta Giardiniera", K. 196 (complete opera). Gerhard Unger, Helen Donath, Werner Hollweg, Jessye Norman, Tatiana Troyanos, Ileana Cotrubas, Hermann Prey; Chorus & Orchestra of the Norddeutsche Rundfunk; conductor Hans Schmidt-Isserstedt. Philips stereo 6703 039. (3 discs, boxed, with libretto).

This is an early Mozart opera — written when he was only 18 and, one presumes, rarely performed for some reasons connected with the fact of the composer's youthfulness.

Having, now, heard the complete opera for the first time, I am at a loss to understand its neglect. Admittedly, it has a libretto of quite remarkable inanity by modern standards — but it is only fractionally worse than those supplied by Da Ponte and other celebrated librettists of the day. Apart from this, the opera's main fault lies in its lack of vocal ensembles and the excessive number of long solo arias. As the musical material used for these is excellent and beautiful, this fact is not of serious importance.

In almost every respect, this is a well-made, mature 3-act opera, certainly deserving of a return to the repertoire. There are, throughout the work, early clues to thematic and dramatic ideas Mozart was to use in later works, most particularly in his great operas. K. 196 may, thus, be regarded as a trial balloon by the standards of a genius; as opera, it is certainly superior to most of the work by older and more experienced contemporaries of Mozart's. Because of the nonsensical libretto, the work cannot be clearly classified as either comic or serious; it contains elements from both types of opera.

I have said enough to indicate that I regard the opera as a major work of considerable merit; it is also one that I found it great fun to listen to, not least for its abundance of fine melodies. My only reservation, as regards the score, is the length of individual arias, most of them being in full sonata form. The score as such, vocal and instrumental, is overflowing with ideas and tunes.

The performance does the work fullest justice. Of the seven singers — four ladies and three men — Helen Donath, Werner Hollweg and Tatiana Troyanos get my top marks, for singing and acting alike.

The only one I was less than happy with is Miss Cotrubas — a trifle shrill and with a rather thick accent; all the rest, and the chorus, perform splendidly. The orchestra, of true 18th-century dimensions, produces a ravishing sound and I was delighted by the direction of Schmidt-Isserstedt, a composer I had not thought of in connection with Mozart. His reading is both firm and sensitive and he supports his singers beautifully.

Finally, mention should be made of the recording itself. Produced by Erik Smith in Hamburg, it offers some of the most convincing and life-like stereo I have yet heard — the kind of sound that even quadraphonics will hardly improve on.

★ ★ ★

DANIEL ADNI PLAYS DEBUSSY. Arabesques Nos. 1 & 2; Suite Bergamasque; Feux d'artifice; Ballade; L'Isle joyeuse; Poissons d'or; Reflets dans l'eau; Mouvement. HMV stereo HQS 1262.

Mr Adni is an Israeli-born, and now London-based pianist in his early twenties whom I had not heard before. It is, of course, impossible to assess an artist from a sample such as this one — it must be presumed that his sponsors — who, in this instance, included Klemperer, Menuhin and Anda — knew what they were about and that Adni's is a great talent.

As judged from this recording, which is excellent acoustically, Daniel Adni is a highly accomplished player and, despite his lack of years, equipped to play even the most difficult of romantic works with success. To my way of thinking, he is not quite right for Debussy; he is a little too romantic, he exaggerates the watery and dreamy elements in Debussy's music to a point where I find myself crying out for a little more robustness.

Let me hasten to add that this is a wholly subjective reaction; I tried the record on some others and found them unreservedly delighted with Mr Adni's interpretations. In any event, Adni is a pianist to watch and anyone interested in Debussy (the Suite Bergamasque in particular) would do well to try this fine disc.

★ ★ ★

A MOZART LIEDER RECITAL — Dietrich Fischer-Dieskau, baritone; Daniel Barenboim, piano. H.M.V. stereo ASD 2824 (with bi-lingual texts).

After reaching the very peaks in his profession, both in opera and on the concert platform, the quite indefatigable Fischer-Dieskau has, more recently, set out to explore and record the wider reaches of the Lieder repertoire, mostly unknown and neglected.

That he should devote a whole disc to the songs of Mozart will come as no surprise to a Mozart lover. Even though most of these songs are of almost spartan simplicity, they are far from naive and their apparent lack of sophistication constitutes quite a challenge, worthy of a great singer's interpretative powers. Besides, Mozart's songs have been little heard and remain hardly appreciated by listeners as much as by performers. It is a fine repertoire and worthy of anyone's attention.

Julian Russell is currently overseas, and in his absence, Classical Recordings are being reviewed by Paul Frolich.

CLASSICAL RECORDS

What, at first, does come as somewhat of a surprise is this singer's teaming up with Barenboim. This pianist did, in fact, make quite a name for himself as a Mozart player, though his Mozart usually is very personalised and looked at a little romantically. At the same time, Barenboim has done little "accompanying" as such other than from the conductor's podium and, even then, more often for fellow-instrumentalists than for singers.

Fischer-Dieskau has, traditionally, worked with Gerald Moore, Jorg Demus, Erik Werba — all of them lieder specialists and musicians closer to his own generation. For these reasons, I was indeed surprised to hear of this release; yet, in the event, it works out quite splendidly. Barenboim, quite clearly, is one of the finest musicians about and whoever first thought of associating these two great artists, deserves a pat on the back.

It would be too much to expect that the artists should see wholly eye to eye on every point of interpretation; in fact it probably would be little more than dull if they did. Whatever differences there are merely add to the spice of this disc. It would serve little purpose to discuss, one by one, songs which are not known to more than a few experts. Suffice it to say that they are all worth knowing, very beautifully sung, played and recorded and that they include the famous "Das Veilchen", known to most concert-goers as an encore.

★ ★ ★

JEAN-PIERRE RAMPAL — Flute Concertos by DEVIENNE, NAUDOT & LOEILLET. Antiqua Musica Orchestra, conducted by Jacques Roussel. Philips Universo stereo 6581 008.

A few years ago, hardly a month went by without some new release of a Rampal recording, but his activities seem to have declined of late. Rampal is, of course, a superb artist, a magnificent flautist and a principal actor in the great revival of baroque music — all these points are again made clear by this disc.

Although I had not previously heard this record, I suspect it is a re-issue of something first released about 1966. However that may be, the playing of soloist and orchestra cannot be faulted in any respect and the recorded sound is brilliant and entirely realistic.

What of the music, though? Well, it is all French, of the 18th century and not of any real importance, though pleasant to both ear and mind.

There are strong indications that many music-lovers are beginning to tire of the stream of minor baroque works. In this instance, the concerti are No 2, in D, by Francois Devienne (about 1790), op. 17 No 5, in G, by Jacques-Christophe Naudot and a D major one by Jacques Loeillet (both about 1740). There is little else to be said about them, a fact apparent to the writer of the accompanying notes which are almost wholly devoted to a discussion of 18th century politics, of little relevance to the music.

There is not an un-beautiful sound or moment on this disc, nor a hint of dullness. Listen to it, marvel at the playing and wallow in the sound — I fear that, ten minutes after, you will remember nothing at all. If you agree with me that there ought

to be something memorable in a composition, this disc will be a waste of your time.

★ ★ ★

CALLAS & DI STEFANO AT LA SCALA. Duets and Scenes from Rigoletto, Tosca, I Puritani, La Boheme, Un Ballo in Maschera; with the orchestra of La Scala, Milan; conductors Tullio Serafin, Victor de Sabata, Antonino Votto. H.M.V. stereo OASD 7572.

It is timely that this disc should be released now, after Madame Callas' announcement of a come-back. I don't suppose any of those in the know had ever really thought of her as having retired and it is good to know she hasn't.

While Callas and di Stefano did a lot of work together and shared "first" place in the 1950s, he never became a figure of controversy and when, for all practical purposes, he retired from the operatic stage, he did so unchallenged. Callas, by contrast, always had plenty of detractors and she was, at what may have been a crucial moment, overthrown by the miracle of Joan Sutherland.

The items re-issued on this record present both artists at their best and at the peak of their form. Every one of these items is near-perfect musically and memorable as a recording — as a permanent record of one of opera's golden moments. In the long run, what matters is the music and fine singing; of these there is plenty on this disc, enough for anyone's true enjoyment.

★ ★ ★

RACHMANINOV — Piano Concerto No 2 FRANCK — Symphonic Variations. Alexis Weissenberg, piano; Berlin Philharmonic Orchestra, conductor Herbert von Karajan. HMV stereo OASD 2872.

Since every pianist must have these two works under his belt before he may tour the five continents as a virtuoso, a circus turn or a "celebrity", it probably is not to be wondered at that the works continue to appear on record as well. At present, my catalogue lists fifteen versions of the concerto, eight of the Franck work — as many again have, no doubt, been deleted since the advent of the LP.

It so happens that this proliferation is good luck for us — it means that there are sufficient good versions of these works on the market for any who might want them; it also means that any competing product needs to be pretty good. This one, believe me, is NOT! Over the years, Karajan has been much criticised for conductor's excesses and often for very minor trespasses. Likewise, German recording engineers have often been unfairly attacked for their over-enthusiastic twiddling of knobs. Not so this time!

Enough has by now been heard from Alexis Weissenberg to establish his firm reputation of an excellent pianist, particularly in the Slavic romantic repertoire. You'd have difficulty finding this out here. He has not been allowed the least independence or originality by Karajan and the sounds produced from his piano (a slightly peculiar instrument?) are often swamped by the orchestra who, on this occasion, are remarkably undisciplined.

Apart from disregarding the soloist and his possible sentiments, Karajan is extremely wilful with his tempi and phrasings, particularly towards the end of the Franck, where he simply races away.

These little points apart, my principal argument is with the technicians who have introduced quite ludicrous variations in dynamics, such as one could never hear (or bear) in a live performance and such as to make nonsense of the idea of "fidelity" — in place of hi-fi, all they've given us is hi-noise.

★ ★ ★

HAYDN — String Quartets opus 76, Nos 1 & 4 (Quartets No 75, G major and No 78, B flat major). Amadeus Quartet. D.G.G. stereo 2530 089.

At the risk of repeating myself (see September issue), I must say that acceptable performances, indeed any performances, of Haydn's great string quartets are much too rare. They are so rare that one has no proper basis for comparison; in this case, although these performances are certainly very fine ones, I should have been grateful for some competing record, just to re-assure myself.

Having heard the Amadeus Quartet, in England and on their Australian tours for Musica Viva, I know that they are very fine musicians and truly appreciative of Haydn's work. The quartets of opus 76 date from 1799 / 1800 and are among the great works of Haydn's maturity. The playing on this disc is very fine indeed, the music is marvellous and the recording first-rate.

And yet — loving Haydn, admiring the Amadeus — I have some misgivings. Is the sound perhaps just a little too perfect? After all, I know what the Amadeus Quartet sounds like and they do not, in life, sound quite like this. Have the engineers fiddled a little too much with the balance? Norbert Brainin is a brilliant leader, but I've never heard his first violin in as dominating a role as it plays on this disc — much to the detriment of Martin Lovett's mellow cello-sound.

And, acoustical questions apart — how about aesthetic principles and value for money? It's a fine disc, to be sure; but, with less than 2½ inches taken up by track on side 1 (the G major work), was there any valid reason for cutting down on the repeats asked for by the composer and heard in live performances?

Unfortunately, there are no competing recordings, at least of No. 75 and, to be honest, I doubt that we could expect better ones from anyone else. So, let's be thankful for all the felicities that are here revealed!

★ ★ ★

THE WORLD OF THE TRUMPET. Decca stereo SPA 260. Although the title of this record is a slight exaggeration, the disc does serve as a useful sampler of some of this amazing instrument's repertoire.

The collection opens with Jeremiah Clarke's Trumpet Voluntary, "The Prince of Denmark's March," expertly played by the trumpeters of the Royal Military School of Music. The 1700 version may have been rather more interesting and more nearly of concert standard, but this lot make quite a splendid noise and obviously enjoy doing it.

The next piece, Haydn's E flat concerto, is the least successful one of the disc. Played by Paolo Longinotti, with the Suisse Romande Orchestra under Ansermet, the recording was made about 1959 and it shows its age; in any case, there have been numerous better and more polished versions since then and one does best to forget this part of the record.

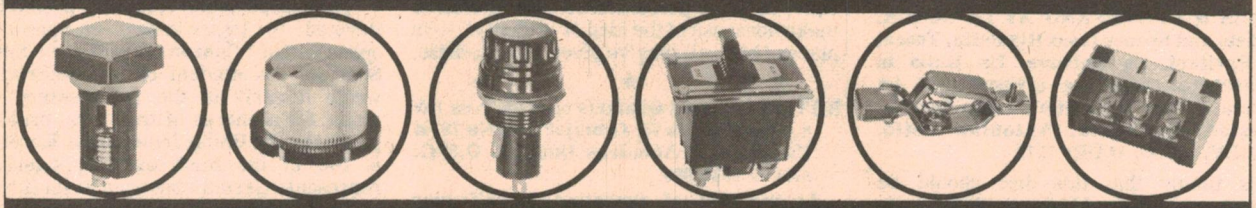
Vivaldi's concerto for 2 trumpets, played by John Wilbraham and Philip Jones, with the Academy of St. Martin-in-the-Fields, is a very different matter. The work is a lovely piece, there is marvellous interplay between the two trumpets and the playing is impeccable, as is the sound.

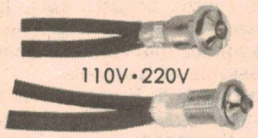
The second side, very appropriately, is devoted to lesser-known composers. It opens with a "Canzon Cornetto" by Samuel Scheidt — a student of Sweelinck's, who wrote it early in the 17th century. This music for a chorus of trumpets, brilliantly played by the Philip Jones Brass Ensemble, is full of the most exciting sound and represents German baroque at its finest. It shows none of the formal stiffness one often associates with Schutz and his contemporaries — rather it glories in the variety of sounds that can be evoked from a whole ensemble of trumpets.

The next work is Hummel's E flat concerto, played by Michel Cuvit, again with the Suisse Romande; this is from a 1968 recording of high quality and offers a superior kind of performance. The festive rococo sounds come a little strangely after the Scheidt, but one is left in no doubt about Hummel's accomplished musicianship. The solo part in this concerto is less exposed than is Haydn's and the trumpet is much better integrated into the ensemble. The work is of great beauty and ingenuity and I was particularly taken by the opening section of the lovely Andante which shows Hummel's closeness to Beethoven.

The final piece on this exceptionally varied disc is a Concerto for Seven Trumpets and Timpani by Johann Ernest Altenburg (1734-1801). Given a virtuoso reading by John Wilbraham, Michael Laird and the Philip Jones Ensemble, this work abounds in quite remarkable sound effects, often bordering on the weird and ranging in style from early baroque right to apparent atonality.

WIDE VARIETY OF ELECTRONIC PARTS...





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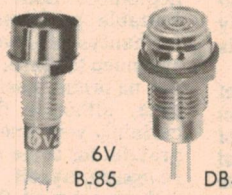

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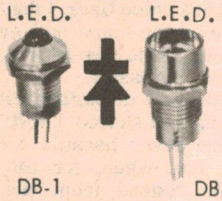

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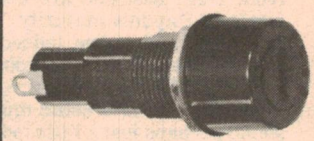

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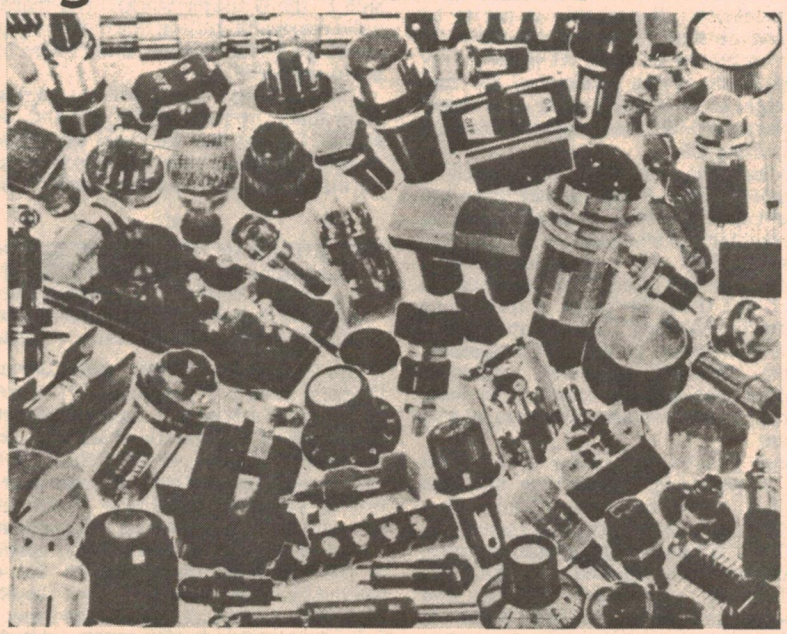

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VARIETY FARE

REVIEWS OF OTHER RECORDINGS

Devotional Records

GLORY LAND WAY. Reg Lindsay, Stereo, Festival Harlequin series L-25062.

If memory serves me correctly, this is quite an old recording — old enough for Reg Lindsay to be wearing a thin tie and a haircut short back and sides. The hymns, too, are mainly traditional with two or three newer titles that were popular a few years back:

Glory Land Way — Just A Closer Walk — The Old Rugged Cross — Glory Land March —Bringing In The Sheaves—Back In those Good Old Days — I Saw The Light — Beautiful Isle Of Somewhere — It Is No Secret — What A Friend — When My Lord Picked Up The Phone — I Heard My Mother Call My Name.

Reg Lindsay sings them fairly straight, backed with chorus, bass and rhythm guitar, and slight C & W bias. Diction is good and, if the titles appeal, you could like the result. But sample a track or two to make sure. Quality, by the way, is quite normal. (W.N.W.).

★ ★ ★

TELL IT LIKE IT IS. Composed by Ralph Carmichael and Kurt Kaiser. The West Epping Methodist Youth Choir. Mono, Parker 007. (From Parker Recordings, 9 Carmel Place, Winston Hills 2153).

Behind this recording is a choir of eighteen young vocalists, five musicians, a musical director and various other helpers who tried to do something positive by communicating their faith through this relatively new christian musical. The focus was primarily on live presentation in local churches and this recording is largely the result of interest by the people involved. The choir was fortunate in having the sympathetic support of recording engineer Parker Oakes.

Can the recording compete with professionally produced versions? Of course not because, mercilessly, it shows up the very common imperfections of amateur performers. But, if it's a stepping stone to better things or an inspiration to other groups to "have a go," it will have served a wider purpose. (W.N.W.)

★ ★ ★

GOLD, INCENSE AND MYRRH. By Sister Miriam Therese Winter, sung by the Medical Mission Sisters and Friends. Stereo, Avant Garde AVS-136. (From Move Records, 660 Swanston St, Carlton Sth, Vic 3053 $5.95).

Christmas is fast approaching and this American imported disc, in its rich gold double-fold album, was the first reminder I received of the fact. And a very pleasant, gentle reminder it was.

Composed by Sister Winter, these songs of the nativity have a happy, new sound and they are presented with unpretentious skill by the sisters, supported by a small, predominantly string orchestra. And, for your guidance, the words are set out in full inside the jacket:

Wonderful — Child Of Morning — Christmas Ballad — He Comes — Song Of Birth — In The Beginning — Silent The Night — Take Courage — No Longer Alone — O What A Happening — Song Of Glory — Peace Upon Earth.

While the theme is the Nativity, the melodies are not selective to the Christmas period, as are the traditional carols. And they are of a kind that could find you playing and enjoying them right throughout the year. Well worthwhile, especially if you're already stocked with the more usual Christmas fare. (W.N.W.)

★ ★ ★

JIMMY OWENS CONDUCTS. The Jimmy Owens Orchestra. Stereo, Light LS-5570-LP. (From Sacred Productions Aust, 181 Clarence St, Sydney and other capitals).

Most orchestral devotional discs I have heard to date have presented familiar classical or traditional themes. This one is different, in that it centres on ten modern devotional songs composed by Jimmy Owens himself. To emphasise the point, the sleeve carries the lyrics in full, though not a word is spoken or sung.

The songs are: A Better Life — He Wants You To Fly — God So Loved The World — Where Will You Go — Forgive Me My Friend — The Illusive Dream — Travellin' Music For A Happy Soul — What A Wonderful Life — Right Now — T'was On A Cold And Wintry Night.

If you know the songs, you'll automatically fit the words to the music. If you don't know them, the impact of the album will be that of a modern orchestral selection, which could as easily be from a film soundtrack.

A criticism? Not at all. Simply a fact of life that a great deal of music only becomes devotional when you put devotional words to it. As it is, it is pleasant, tuneful, very well recorded and sounds fine through a quadraphonic system. (W.N.W.)

Instrumental, Vocal and Humour

4 CHANNEL GOES POP. Quadraphonic, Interfusion (Festival) LTFL-34849Q.

From the title and the cover design, one might conclude that this album from King Records, Japan, was aimed at the youth scene. In fact, it's nothing of the kind, being a collection of melodies and sounds as gentle as you'll hear anywhere.

Mamy Blue — Tout, Tout, Pour Ma Cherie — Superstar — It's Me That You Need — Les Champs Elysees — Diamonds Are Forever — Red Sun — Pour Un Flirt — Stay — Melody Fair — Ani Hol Em Al Naomi — Love Story.

The quality is very clean and the separation is particularly good. Gentle, melodic quadraphonic at its best. (W.N.W.)

★ ★ ★

STOKOWSKI. Tchaikovsky Symphony No 4-F minor. Skyrabin: Etude in C-sharp minor, Op 2 No 1. American Symphony Orchestra. Quadraphonic, Vanguard Cardinal series, VCS-10095.

Curiously, this recording came my way about the same time that Stokowski was on TV with David Frost, explaining his involvement with the American Symphony Orchestra. The jacket notes give a brief biographical sketch of Stokowski but devote a couple of columns to the principal work. Enthusiasts in the classical field will doubtless have their own ideas whether this particular performance is likely to interest them.

But, Philistine that I am, while listening to the music happily enough, I found myself wrestling once again with the whole question of matrix quadraphonic in relation to a classical orchestra. Whereas experience dictates that the orchestra should be out there in front, matrix quadraphonic puts the issue in doubt. Sometimes one is pleasantly surrounded by the sound, only to be accosted, immediately after, by a group of disembodied overtones emanating from the most unlikely place.

Of course, one can offset the effect by discretely retarding the back channels, but one shouldn't have to rely on manipulating gain manually — or automatically. This is where CD-4 comes out the winner by a mile.

But this is matrix, albeit cleanly recorded and, if you want the best out of it, then be prepared to fiddle the level of the back channels. (W.N.W.)

★ ★ ★

MANDINGO. The Primeval Rhythm Of Life. Quadraphonic SQ, Columbia Studio 2, Q4-TWO-400.

The sound on this album turns out to be more or less as you would expect from the title — only more so! Opening with a study in rhythm strongly reminiscent of a corroboree, it introduces progressively melody and atmosphere borrowed from a variety of cultures but executed with an even greater variety of percussive and wind instruments, plus guitars, piano and electronic organ. More than forty are listed on the jacket.

The titles match the sound: Mandingo — Black Rite — Medicine Man — Jungle Wedding — Chant Of The Virgins — Sacrifice — Tiger In The Night — Black Fire — Moon Goddess — Pagan Ritual.

Having purchased the album, you are invited to listen or to dance, according to your inclination. If your hair is grey, you may be inclined to do neither but if you're at the other end of the age spectrum, you'll rate it as wild, man, wild.

Reviews in this section are by Neville Williams (W.N.W), Harry Tyrer (H.A.T.), Leo Simpson (L.D.S.), Gil Wahlquist (G.W.), and Norman Marks (N.J.M.).

VARIETY FARE

And if you do release it on the neighbourhood, they'll at least be treated to very clean sound, well spread around by the SQ quadraphonic. If the title intrigues you, have a listen. As I said, it's what you'd expect and more! (W.N.W.)

★ ★ ★

MOVIE HITS. Enoch Light and The Light Brigade. Quadraphonic, Project 3 (Festival) SPJL-934611.

As the notes indicate, Enoch Light has recorded dozens of movie theme albums, which doesn't make it easy to say anything new about this one. First off then, it will be a matter as to whether the titles have a particular appeal:

The French Connection — Godfather Waltz — The Summer Knows — Eglantine — Clockwork Orange, Title and Theme — This Way Mary — "Shaft" Theme — Diamonds Are Forever — Fiddler On The Roof — To Be The One You Love — Long Ago, Tomorrow — I Still See You.

Played by the Light Brigade musicians, and under the guidance of Enoch Light, Tony Mottola and Dick Hyman, there's ample talent to ensure that the performance is impeccable, while the Project 3 engineering is equally above reproach. In fact, it adds up to very pleasant, very clean, well dispersed sound. (W.N.W.)

★ ★ ★

FILM THEMES MY WAY. The Royal Philharmonic Orchestra conducted by Vic Lewis. DJM stereo DJL 34914. Distributed in Australia by Festival Records Pty Ltd.

If you like lushly orchestrated film themes, then this record could be your bag. Personally, I found it dull. The themes are innocuous and the arrangements lack-lustre. Record quality is okay.

Some of the tracks are as follows: Let Me Dream — Sailing Homeward — Innocent Bystanders — England Made Me — The Me I Never Knew — Ben — The Shadow Of Your Smile — Brother Sun, Sister Moon. (L.D.S.)

★ ★ ★

THE ORIGINAL REUNION OF THE GLENN MILLER BAND. GNP Cresendo mono GNPL 1010.

A real collector's item, this one. Recorded at the time of release of the film, "The Glen Miller Story" back in 1954, the performance was presented live at the huge Shrine Auditorium in Los Angels. It was conducted by Billy May along with a host of associates of Glen Miller and master-of-ceremonies was Gene Norman. The whole record comes across very well — the atmosphere of pleasant anticipation from the audience and the driving enthusiasm of the players. Some tape hiss but who cares?

Ten tunes are presented: Moonlight Serenade — Anvil Chorus — Little Brown Jug — Too Little Time — American Patrol — A String Of Pearls — Pennsylvania 6-5000 — Tuxedo Junction — Song Of The Volga Boatmen — In The Mood. (L.D.S.)

★ ★ ★

HORIZONS. Manuel and the Music of the Mountains. Studio 2 stereo TWO 414.

Here is another pleasant disc from Manuel and his "music of the mountains." A lively string orchestra playing middle-of-the road arrangements of some popular evergreen and more recent numbers. Quality is good. The disc is just fine as a background to dining or conversation.

Twelve tunes are featured: Horizons — Alone Again Naturally — Spanish Flea — If — The Twelfth Of Never — El Toro — Love theme from "Spartacus" — Brother Sun And Sister Moon — Lady Caroline Lamb — Jamaican Rhumba — Killing Me Softly With His Song — Tequila. (L.D.S.)

★ ★ ★

MOVIE THEMES. Leon Pops Orchestra. Quadraphonic, Interfusion (Festival) ITFL-34850Q.

There's no two ways about this 1973 release from King Records, Japan: it's a bright, tuneful and very pleasant collection of popular movie themes, enhanced by the four channel treatment: Love Theme From The Godfather — Here's To You — Windmills Of Your Mind — Theme D'Amour — Sunrise, Sunset — Bless The Beasts And The Children — Les Parapluies De Cherbourg — Sounds Of Silence — From Russia With Love — The Impossible Dream — Where Did Our Summers Go? — Love Story.

This sort of material is just about ideal for matrix surround sound and the quality generally is excellent, perhaps just a trifle "stringy" on the inner tracks. But it's very pleasant, nevertheless. (W.N.W.)

BEYOND THE BLUE HORIZON. Reubert Hayes at the Conn Theatre Organ. Stereo, Parker PRS-008. (From Parker Recordings, 9 Carmel Place, Winston Hills, NSW 2153).

Like many others of my generation, I remember Reubert Hayes from way back: Burwood and Kogarah in Sydney before the war, Brisbane during the war, then back to the Sydney Plaza and Regent. Here he seeks to recreate some of that former atmosphere, though on a more limited scale — on the Conn electronic in his own home. It lacks the scale and the impact of the big pipe instruments but, if you want a record for old time's sake, the atmosphere is there.

The titles: Beyond The Blue Horizon — Spanish Eyes -- Kismet Selection — Stranger On The Shore — Swanee — Old Comrades March — Estrellita — Begin The Beguine — My Way — I Don't Know How To Love Him — We'll Meet Again.

The last named two are probably the least successful, but Swanee, Old Comrades and Beguine emphasise the capabilities of both the player and the instrument. In a few spots, the electronics are stressed to the limit but overall, the sound quality is up to expectations. (W.N.W.)

★ ★ ★

BARRY BAILEY AT THE THEATRE ORGAN. Stereo, Calendar L-15124.

Barry Bailey is introduced on the jacket notes as one of the younger generation of organists, who is well known in the Brisbane area and, amongst other things, is associated with the Conn Organ Centre at Red Hill. For this album he uses the 3-manual model 650.

His style makes an interesting contrast to that of Reubert Hayes, ("Beyond The Blue Horizon). Barry Bailey generally seems to favour lighter registrations and a more uniform sound, and it is not surprising to read that he plays regularly in Brisbane's leading function rooms.

The tracks: Happy Days Are Here Again — If You Knew Susie — Five Foot Two — Vilja — Charleston — Our Director, March — Little Street Where Old Friends Meet — Vienna City Of My Dreams — Varsity Drag — Tales From The Vienna Woods.

Having in mind that the sound is emanting from loudspeakers in the first place, the quality is clean and well balanced. (W.N.W.)

★ ★ ★

THE SOUND OF JESSE CRAWFORD at the Majestic Pipe Organ. Stereo, MCA Gold Star (Astor) DL-74028.

Back in the thirties (good grief!) I tended to rate Jesse Crawford well below others like Reginal Dixon because he seldom seemed to go in much for gymnastics and sound spectacle. And surely that's what Wurlitzers were all about!

But if ever Jesse Crawford made his point and justified the description of "poet of the organ" it's in this album. He plays as if he has all the time in the world, and as if the thing that really matters is sound texture and the melody of the moment.

I'm not sure about the age of this recording but the themes aren't too grey and the sound quality is fine:

Climb Every Mountain — Where Or When — Till There Was You — Small World — Lavender Blue — Theme from "The Unforgiven" — Theme From "A Summer Place" — Smile — You Are Beautiful — Till Tomorrow — Mr Lucky — Night.

If you're a popular organ enthusiast, this is one you should add to your collection. Maybe it was the late evening and the coffee but I have never enjoyed more listening to Jesse Crawford. (W.N.W.).

★ ★ ★

THE SWORD IN THE STONE. Walt Disney presents. Disneyland mono DQ 1236. Distributed in Australia by EMI (Australia) Pty Ltd.

With the Christmas season upon us, it is appropriate that "Fairy Tale" material should be at hand to enchant the "Littlies." They'll just lap up this enjoyable trivia which is so well produced by the Disneyland studios.

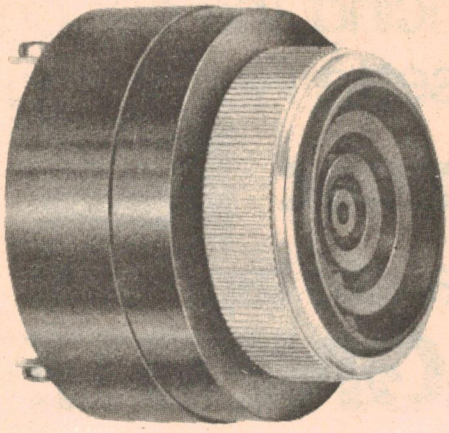
Only six tracks are featured but they are all quite long so that playing time is reasonable: The Legend Of the Sword In The Stone — Higitus Figutus — Mad Madam Mim — That's What Makes The World Go Round — A Most Befuddling Thing — Blue Oak Tree. (L.D.S.)

★ ★ ★

A TIME FOR TEARS. Charlie Rich. Sun Records mono NL 1029.

Someone must be putting me on. The cover shows a guy with a greased-back hair-do playing a piano in what looks to be a blue mood. But when I played the record, it sounded like a dead ringer for an early Elvis Presley album. Except that the quality is good, even though it is in mono. Great for jiving at a party.

Eleven tracks are featured: Gentle As A Lamb — The Wedding's



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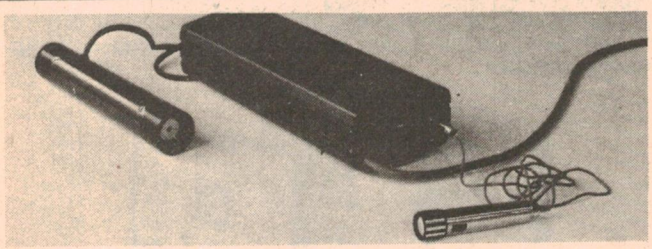

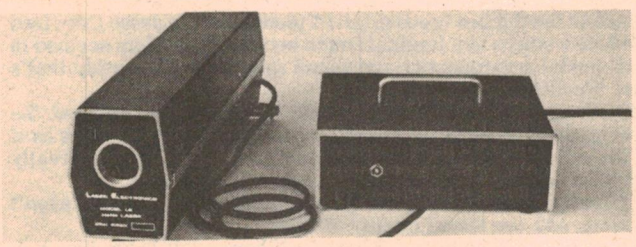

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VARIETY FARE

Over — You're Gonna Be Waiting — Midnight Blues — My Heart Cries For You — Goodbye Mary Ann — Finally Found Out — Baby I Need You — It's Too Late — I've Lost My Heart To You — My Baby Done Left Me. (L.D.S.)

★ ★ ★

THE MUSIC OF GILBERT O'SULLIVAN. Roy Budd. Astor Quadraphonic 1021.

Nothing much is said about the artist on this disc. The cover notes are all about Gilbert O'Sullivan. In fact, the cover even shows what is purportedly a silhouette of G.O'S playing the piano. What I can tell you is that the disc comprises instrumental arrangements for electric piano, played by Roy Budd and orchestra. The arrangements are pleasant enough although a little "busy." Its okay as a pleasant background. Sound quality is good.

There are twelve tracks: I Hope You'll Stay — In My Hole — Alone Again Naturally — What Could Be Nicer — Get Down — Ooh-Wakka-Doo-Wakka-Day — Who Was It? — Clair — No Matter How I Try — Nothing Rhymed — Matrimony. (L.D.S.)

★ ★ ★

SOUND OF THE SITAR. Ravi Shankar. United Artists stereo L-34958.

Those who wish to sample Hindustani Music played by the master can do no better than get hold of this album. It has definitive and analytical cover notes and shows the structure of some of the musical forms in staff notation. Sound quality is excellent. Those not familiar with this type of music should sample it before buying. (L.D.S.)

★ ★ ★

LITTLE DRUMMER BOY. Steve Benbow and the folk choir. Calendar mono DUL 1004.

No sleeve notes on this album but its a very pleasant sounding boys' choir led by an equally pleasant tenor, Steve Church. A good record for the Christmas season.

Twelve songs are sung: Little Red Donkey — White Christmas — The Little Drummer Boy — Where Have All The Flowers Gone — Yesterday — A Windmill In Old Amsterdam — Last Night I Had The Strangest Dream — Buffalo Boy — Oh My Darling — Skye Boat Song — Snowy White Snow And Jingle Bells. (L.D.S.).

★ ★ ★

LORETTA LYNN'S GREATEST HITS MCA Stereo MAPS 1082.

Loretta Lynn has recently done very well on the hit parade with "One's On The Way" which is a fairly rare occurence these days for a country and western singer. But Loretta is very popular and should have no trouble selling piles of this album. Its all good C&W stuff. Sound quality is okay.

Twelve tracks featured: Don't Come Home A Drinkin' — Before I'm Over You — If You're Not Gone Too Long — Dear Uncle Sam — The Other Woman — Wine Women And Song — One's On The Way — You Ain't Woman Enough — Blue Kentucky Girl — Success — The Home You're Tearing Down — Happy Birthday. (L.D.S.).

★ ★ ★

PORTRAIT OF CAT STEVENS. The Mike Batt Orchestra. Calendar stereo L 25030.

This album is rather like homogenised milk — it lacks flavour. What makes a Cat Stevens song is the fact that it is a song. Present it without the lyrics and it becomes entirely forgettable. Sound quality is okay.

Ten tracks are presented: Matthew & Son — Lady — Wild World — Tuesday's Dead — Moon Shadow — Father & Son — Lady D'Arbanville — Morning Has Broken — Portobello Road — I Love My Dog. (L.D.S.)

★ ★ ★

JOHNNY CASH & JERRY LEE LEWIS SING HANK WILLIAMS. Calendar stereo L25010.

Two C & W artists, Johnny Cash and Jerry Lee Lewis are teamed together on this album to present a brace of Hank Williams songs. They don't sing together though. Johnny sings on Side One and Jerry sings on Side Two. Maybe if they had been a duet it would have been a better presentation. Sound quality is just so-so but the disc will doubtless have a lot of appeal to C&W fans.

The tracks by Johnny Cash are: Hey Good Looking — I Could Never Be Ashamed Of You — I Can't Help It — I Heard That Lonesome Whistle — Cold, Cold Heart. The tracks by Jerry Lee Lewis: Lovesick Blues — You Win Again — Your Cheatin' Heart — Jambalaya — Settin' The Woods On Fire. (L.D.S.)

★ ★ ★

ROLF HARRIS. Stereo, Interfusion (Festival) 2-record set L-45183 / 4. $7.95.

What do you expect of a Rolf Harris album? A mixture of music and clever tomfoolery? Items of the type with which the artist is so commonly identified?

If that's what you expect and want, you are likely to be disappointed with this 2-record album. Basically, all four sides are devoted to songs from the Rolf Harris repertoire which might typically fit between his well known acts. They're very well done but, somehow, without the familiar highlights, they add up to a long procession of routine numbers — 24 all told.

Just a few titles: Salvation Army Citadel — What's Become Of Ned Kelly? Two Little Boys — Come Off It Blue — Bunyip — Boney — Early Morning Rain — Good Ship Venus — Moscow's In Love.

If you like this lesser known side of Rolf Harris, fine! But have a care if you prefer the "Tie Me Kangaroo Down" recipe! (W.N.W.)

★ ★ ★

DOUBLE GOLD. Sandy Scott. ATA stereo L 45187 / 8. 2-record set $7.95.

Here's good buying if you're a Sandy Scott fan — and there must be many, if Sandy's visibility on television and the Sydney club scene is any indicator. He always gives a smooth, polished performance. Sound quality is variable, however, so listeners with "golden" ears might not be pleased.

Twenty-five tracks are featured, some as follows: Love Is a Beautiful Thing — Temptation — Wallpaper Roses — This Iis My Life — Now — It's Impossible — If Ever I Would Leave You (L.D.S.)

★ ★ ★

TRUCKER'S PARADISE. Del Reeves. United Artists mono UAL 34877.

Mono LP's are few and far between these days but this is quite a pleasant C&W album that does not really need stereo to make it listenable. And that in itself is something. Quality is okay and there is a good variety in the songs.

Eleven tracks are featured: Trucker's Paradise — Long Black Veil — Travellin' Light — Raining In Kentucky — The Legend Of The Highway — Paper Covered Comb —

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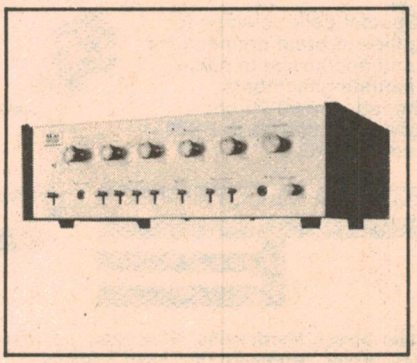

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AK58P

VARIETY FARE

The Older The Violin The Sweeter The Music — Her And The Car And The Mobile Home — Bad News — Three Years Late — Another Pretty Country Song. (L.D.S.).

★ ★ ★

MIKE AND BERNIE WINTERS IN TOYLAND. Carnaby stereo L 25033. Distributed in Australia by Festival Records Pty Ltd.

If you're a sucker for punishment, just buy this album for your tiny tots. On the other hand, if you do buy it, this sort of music is probably your standard. Personally, I think this sort of stuff should be tossed in the trashcan. Kids are exposed to enough of this trivia on television. On second thought, if the material was presented without the obvious condescension of the performers maybe it would be palatable to adult ears.

If you're still curious, some of the tunes are as follows: Teddy Bears' Picnic — Inky Spinksy Spider — Go To Sleep My Teddy Bear — That Man Batman — There's An Elephant In My Bedroom. (L.D.S.)

★ ★ ★

HERE COME THE MOM AND DADS. GNP Crescendo stereo L 45197 8. 2-record set $7.95.

Not to be confused with the Mums and Dads that Sydney radio personality Andrea talks to, the Mom (american) and these Dads are a quartet that plays old-time dance music. They started in Spokane, Washington and have branched out from there. If you've ever heard Jack Papworth's Old Time Dance Band you know exactly their style of playing.

Recording quality is okay but buyers of this sort of record aren't likely to be worried about it anyway. While its great for foxtrots, waltzes and so on, it is a bit monotonous to listen to the whole two-record set in one sitting. I did not try.

Some of the tracks are as follows: Roses Of Picardy — Oh Lonesome Me — Till We Meet Again — Five Foot Two Eyes Of Blue — Silver Moon — Cuddle Up A Little Closer — Anytime. (L.D.S.)

★ ★ ★

A DAY AT THE ZOO. Burl Ives. Disneyland mono DQ-1347. Distributed in Australia by EMI (Australia) Pty Ltd.

Burl Ives has just the right approach to singing songs for the toddlers. He sings them straight but with charm and no trace of condescension. You will be able to listen in too, knowing that although the material is "kidstuff" it's not an insult to the kids' intelligence.

Ten tunes are featured: The Whale — Jim Johnsons Mule — The Owl And The Pussycat — The Black And White Pigeon — Oriole — The Robin And The Chicken — Johnny Doolan's Cat — The Wonderful Crocodile — The Robin — The Horse Of Demerara. (L.D.S.)

★ ★ ★

FAT ALBERT. Bill Cosby. Stereo, MCA Records MAPS 6626.

Bill Cosby is at his brilliant best in this selection in which the popular character of Fat Albert (who, he insists, really exists) is featured. Fat Albert's car, described in the first sketch, had a most unusual engine (for a car, that is) and Bill Cosby's description of its peculiarities and imitation of its engine noise is a scintillating 8½ minutes of the raconteur's art. When Fat Albert tries to imitate the success Cosby himself had in avoiding parental wrath, by playing dead, his father quickly finds a way to bring dead men back to life. Fat Albert's hernia arises from the success with the neighbourhood kids of Cosby's own hernia, which was the envy of them all. And so on. I have heard most of Bill Cosby's numerous records, but I vote this one the funniest of them all. (H.A.T.)

★ ★ ★

REPORT ON BRITAIN. David Frost and John Cleese. Parlophone PMEO. 9869.

Though the origin of these tracks is not stated, they are obviously from the original "Frost Report" TV programs. The savage satire is directed mainly against circumstances and personalities in Britain itself, but occasionally a glance is spared for overseas, as in a "report" on Hilton Hotels, those concrete and glass super structures whose "benefits" are examined in typical Frost style. The English private school comes under scrutiny, the motor car, the BBC News Announcer, and the type of program beloved of BBC producers known as "Scrapbook". . . relating to the events of a particular year. Devotees of the Frost style of humour will appreciate the contents of this disc. There is a certain amount of distortion, but this is not important in this type of disc. (H.A.T.)

★ ★ ★

MY OWN NURSERY RHYME. Children's Choir and Instrumental Ensemble with Cynthia Glover and John Lawrenson. Stereo, AXIS 6047 (EMI).

I guess that, if you're ever inclined to buy an album of nursery rhymes, there could scarcely be a more appropriate time than Christmas. And you'll certainly get your money's worth here, with no less than 52 rhymes, virtually all of them favourites; rhymes like Sing a Song Of Sixpence — Twinkle, Twinkle, Little Star — Pop Goes The Weasel — Little Jack Horner and so on.

The subject matter may be juvenile but the ensemble, the orchestra and the recording itself are excellent. You know, I think I secretly enjoyed listening to this one! (W.N.W.)

★ ★ ★

UPON A TIME . . . Tales For Children. Narrated by Susan Tracy. Stereo, Fontana special 6438-051 ($2.75).

There are three entirely different stories on this album, adapted from the tales of Hans Christian Andersen. "The Wild Swans" which occupies the whole of side 1 is the fairyest of fairy tales, with a wicked queen, an incredibly virtuous princess and eleven young princes under a spell which turns them into swans during the day. But it all ends happily!

"What The Old Man Does Is Always Right" is a whimsical tale which would horrify any self-respecting women's libber. "The Shirt Collar" is a fanciful fill for the second side.

It's well done but, tell me, do children still listen to fairy tales? Wot, no picture! (W.N.W.)

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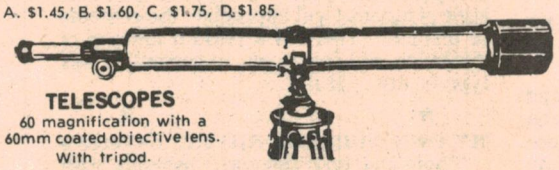

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SORRY, NO C.O.D.

VARIETY FARE

Jazz and Rock . . .

GEORGE GOLLA. Cherry Pie stereo CPS — 1013.

As a true sample of Australian cool jazz, this album would be unbeatable, largely because George, Australia's leading jazz guitarist, is so unflappable. John Sangster (vibes), Ed Gaston (bass), Don Burrowes (flute and baritone sax) and Alan Turnbull (drums) are on some of the tracks with George.

When I talk about Australian cool I refer to the improvisations on "N.P. Blues" and "Over and Out". This sort of sophisticated jazz has grown up only in Sydney and you wouldn't hear it anywhere else in the world.

With engineer Max Harding at the controls, George multi-tracks on a number of performances and on "Blower" he engages in jazz improvisation as a counter to his own solo — quite a feat.

George also re-arranges two classical guitar studies by Sor as ballad performances. These are most effective. The cover presentation is excellent and the information complete. The equipment used by Max Harding is also listed, so if you want to hear what a Philips multi track PRO 71 Recorder and MD 12RF/4 mixing unit, with stereo recorder Scully 280 series can turn out, go to it. (G.W.)

★ ★ ★

TOTAL UNION. Band of Light. Warner Brothers stereo WS 20011.

Phil Key, formerly of the Australian La-De-Das formed this group with the idea of getting back to straightforward rock and roll as he saw it.

The blues is the dominant theme in this album. Phil and his wife Pamela wrote the tunes and lyrics.

The songs deal uncompromisingly with human values, stressing the need for unselfishness and understanding. Key plays guitar and shares the front line with Ian Roue who has a wonderful attack on bottleneck and slide guitar. Ian Rilen is bassist and Tony Beutel is on drums.

The sound of Band of Light is warm, blues rock, and this has been captured by engineer John French.

Of the songs, I prefer "My First Home" and "If" for strength of meaning. (G.W.)

★ ★ ★

NEW ORLEANS SHOUT. King Oliver. RCA Black and White series. Mono. LPV 1003.

These were the last recordings made by Joe "King" Oliver, the New Orleans bandleader who encouraged Louis Armstrong in his trumpet playing and who gave Louis his first worthwhile job.

King Oliver was the greatest trumpet player in New Orleans. His playing set the Creole style. He was the main figure to take jazz of quality from New Orleans to Chicago. These recordings were made in New York in 1929 when the bank freeze was starting and money was short. The jazz age was dying. Fortunately, electric recording had just come in and the recording of Joe's trumpet sound was better than on earlier discs.

"West End Blues" which Oliver composed, sounds superb on this disc. The LP also contains the only decent examples of Oliver's muted trumpet style, widely copied by later players. Luis Russell, Paul Barbarin, Bobby Holmes, Henry Allen, Bubber Miley and Alex Hill were some of the legendary performers on the sessions. Two years after making these recordings, Oliver lost his teeth. He worked as a labourer and died broke in 1938. (G.W.)

★ ★ ★

CHANGE OF THE CENTURY. Ornette Coleman. Atlantic stereo SD-1327.

It's surprising how easy Coleman has become to listen to over the past few years. That's purely a personal reaction, of course, but after listening to hours of rock records played by kids who try everything in the name of music which does not work, it is refreshing to go back to the innovator, Ornette Coleman and find that what he plays will actually go.

Coleman's plastic saxophone and Don Cherry's pocket trumpet team superbly for this LP which has been recorded with a conscience. The quality is great.

In a liner note, Coleman likens his music to the paintings of Jackson Pollock, so if the Pollock painting purchased by the Australian Government catches on, perhaps we should have some Coleman free-wheeling jazz tapes to go with it.

"Ramblin" which opens the LP, is a stunning introduction to Coleman and if you want to get the adrenalin pumping I suggest you drop the stylus on to this one. (G.W.)

★ ★ ★

PARABRAHM. Brian Cadd. Bootleg stereo BLA 034.

Cadd combines a collection of hit tunes on one side of this LP with an extended suite on the other.

This bold move by a rising songwriter and performer has resulted in an LP of more than usual distinction. "Keep On Rockin' " is the best known of the pop side songs. Cadd's vigour and the driving rhythm of the track has already earned it considerable exposure. The same can probably be said of "Heroes."

The tracks have a carnival air about them, with vocal chorus and instruments chiming in to build each number to a climatic ride-out.

The suite is "The Ballad Of A Country Lady" and it is the story of a woman, now old, whose spectacular past is no longer of any concern.

The lyrics are noveletish. Cadd uses them to express a variety of moods. The lively recording was made at Bill Armstrong studios, Melbourne, by engineers Roger Savage and Ross Cockle. (G.W.)

★ ★ ★

STRAIGHT AS A DIE. Matt Taylor. Mushroom stereo L34955.

This is Taylor's comeback album, recorded after spending some time living on a farm at Beechworth, Victoria. The former harmonica player and singer with Chain has returned to the fold with warnings that we are over-doing it, that we are not paying enough attention to "Mother Nature;" a tune of this name starts the album.

One of the tracks "We'll Never do the Same Again" was recorded at a farm using a mobile unit. It has a raw quality which suits Taylor's abrasive vocal style.

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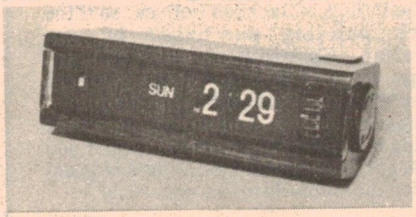

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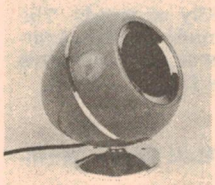

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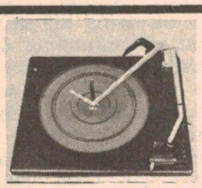

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VARIETY FARE

The problem with the record, springing from Taylor's lyrics, is that it is largely a singing commercial for a new way of life. I agree with the sentiments expressed but I don't think that it comes off as entertainment.

Phil Manning plays good guitar on some tracks, principally on "Chickens" but this is not enough to sugar the soapbox vocalising of Taylor.

John French, of TCS studios, Melbourne, was the engineer in charge of recording Taylor's unusual voice and he achieves a good feeling of live presence. (G.W.)

★ ★ ★

COMIC BOOK HEROES. Rick Springfield. Wizard stereo ZL 201.

It's interesting to hear an Australian sound coming from an LP which was made at Morgan Studios, London.

Yet from the opening track "I'm Your Superman" this is an unmistakeable Melbourne LP in its arrangement and feel. There are even sound effect scraps, the sort of thing Russell Morris used in his early recordings with Ian Meldrum, the performances which set the style of Australian eclectic rock.

The songs themselves have lyrics which are based on melodramatic comic book situations. Springfield, as the singer, takes part in the situations, which have titles "Weep No More," "Why Are You Waiting?", "The Liar," "The Photograph" and "Born Out of Time."

It's a very clever way of linking a number of story ballads. Springfield is a polished performer with an interesting voice and the combined talents of Australia and UK have given us a world-class LP. (G.W.)

★ ★ ★

THE LAST DRIVE-IN MOVIE SHOW. Daddy Cool. Wizard stereo ZL 202.

On the eve of their retirement as a group, Daddy Cool finally produced an album which captured their in-person excitement.

This is a two-LP set recorded last year by Ern Rose and Roger Savage at the Much More Ballroom, Melbourne.

Previously recordings by the group were to me dull and uninteresting. This one really swings. It has life and spirit.

As this was a farewell performance, the group recalled their past by performing for one half as a predominantly vocal quartet and for the second half as a more instrumental outfit. Members of D.C. appearing are Ross Wilson, Ross Hannaford, Gary Young, Wayne Duncan and Ian Winter.

Numbers are old favourites, including "That'll Be The Day," "Come Back Again," "Love In An F.J." and "Daddy Cool." (G.W.)

★ ★ ★

AHMAD JAMAL '73. 20th Century Fox stereo TL34920.

Pianist Jamal plays with an orchestra conducted by Richard Evans for this ballad selection. He favours a Fender Rhodes electric piano and plays in an economical, staccato style for the opener "The World is a Ghetto."

Jamal is less of a soloist and more part of an orchestra, the piano providing the melody, quite often in counterpoint with an un-named guitarist.

It is the orchestra as a whole which has to be considered. The disc can be recommended as an introspective mood piece. (G.W.)

★ ★ ★

SCOTT JOPLIN. The New England Conservatory Ragtime Ensemble conducted by Gunther Schuller. HMV stereo OCSD 7706.

The ragtime compositions of Scott Joplin are played in their original form by this inspired group.

Some of these rags, including "The Cascades" which opens the LP, were played at the St Louis World Fair of 1904 by the Washington Marine Band. Such was their stature and their novelty at that time.

Ragtime was all the go until about 1917 when it was replaced by jazz.

Joplin had published a book of his rags, arranged for eleven instruments and it is this legendary collection which provides the basis for this outstanding recording made in February of this year in Massachusetts, US.

The use made of the flute and piccolo by Joplin is outstanding and at the distance of 70 odd years I issue a solemn warning — this music is still infectious. (G.W.)

★ ★ ★

THE LONER. Vic Sims. RCA Camden stereo CAMS-196.

This record breaks new ground, being recorded at Bathurst Gaol, NSW. Sims is an aboriginal inmate of the establishment who has been encouraged to express himself in his chosen medium of rock music.

He has written a number of songs which have more spirit in them than many others that we hear from the outside.

They are songs of rejection, of the blues and misunderstanding between human beings.

With songs like "Get Back into the Shadows," "Little Barefoot Urchin" and "The Loner" Vic Sims leaps the wall between black and white.

He is accompanied by a group including brass and guitar. Recording engineer was Bruce Brown and re-mixing was carried out at A.T.A. Studios, Sydney. (G.W.)

★ ★ ★

BASS-ICALLY SPEAKING. Jack Lesberg. ATA records ATAL 34782.

Lesberg, who first visited Australia with Louis Armstrong, made this LP this year after deciding to settle here. He plays with a quartet which includes trumpeter Bob Barnard, piano player Chris Taperell and drummer Alan Geddes.

Lesberg bows his way into a beautiful chorus which opens "Stars Fell on Alabama" played as a tribute to the late Jack Teagarden. The arrangement was by American George Barnes and virtually has the bass playing a line usually taken up by the brass. Taperell plays piano obligato.

"Frolic For Basses", another Barnes piece, has Lesberg multi-tracking eight bass parts. He says he told Barnes about the eight bass players on the Sydney Symphony orchestra and Barnes was inspired to write a jazz piece featuring eight bassists. This is a most enjoyable album of mainstream jazz. (G.W.)

NEW ALL-TRANSISTOR STEREO AMPLIFIERS WITH IN-BUILT A.M. TUNER ULTIMATE IN DESIGN— LONG DEPENDABILITY using all silicon transistors 50 WATTS – RMS

SPECIFICATIONS
POWER OUTPUT:
25 watts per channel R.M.S. Total output 50 watts R.M.S. 8 Ohms.
FREQUENCY RESPONSE:
20 cycles to 40,000 ± 1db.
HUM & NOISE:
Aux. 70db. Mag. 60db.
INPUT SENSITIVITY:
Mag. 2mv. Aux. 250mv.
EQUALISED:
Mag. RIAA.
TONE CONTROLS:
Bass 50 c s ± 13db. Treble 10kc s 15db.
HARMONIC DISTORTION.
Less than 0.5 per cent.
LOUDNESS CONTROL:
50 c.s 10db.
SCRATCH FILTER:
(high filter) at 10kc s 5db.
RUMBLE FILTER:
(low filter) at 50 c s 5db.
PROVISION FOR TAPE RECORDER.
Record or play-back with din plug connector.
SPEAKER SWITCHING:
Two sets of speakers can be connected and selected by switch on front panel they can also be driven together.
HEADPHONES:
Headphone jack is situated on front panel.
DIMENSIONS:
16½in X 11in. deep X 5" high Weight 16lbs
TUNER:
This unit incorporates a transistor tuner with a coverage of 530 to 1,600 K. C. Calibrated dial available for all states.
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Regulated power supply with switching protection for output transistors.
SEMICONDUCTORS.
30 silicon transistors plus 7 diodes.

$169.00 Plus Freight
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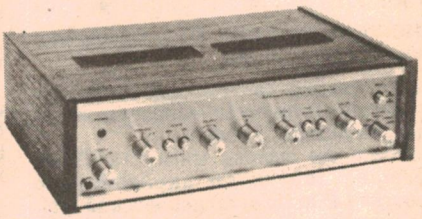

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Model C.700
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Cabinets for above amplifiers in Teak or Walnut Oiled Finish with matching metal trim $10.00 extra

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COMPLETE SYSTEM in 1.6 cubic ft. cabinet. In Walnut or Teak Veneer (Size 24" x 15½" x 11").

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PLAYMASTER 136 STEREO AMPLIFIER

As featured in Dec 72 issue of Electronics Australia

High fidelity amplifier with an output of 13 watts R.M.S. per channel, frequency response 20Hz to 120kHz, distortion 0.2% mag. input equalised to R1AA, bass & treble controls, provision for simulated 4 channel.
Complete kit of parts including **All Transistors. $65.00** as above but less Fairchild **special transistor offer $58.00.** Reg postage $2.00 extra.

As an added feature to the 136 amp we have added provision for headphones with phone jack & switch mounted on front panel which is silver anodised with black lettering & matching knobs. We have also had a special transformer wound for this unit with separate 6v winding for indicator bezel & with electrostatic shield.

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Metal work inc. heat sinks $7.50 post 70c
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At last a breakthrough in the cost for high quality portable radio transceivers of the walkie-talkie hand-held type. We are introducing and offering for sale a fully PMG approved transceiver.

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For 27240 or 27880 Khz operation (state which required) with switch position for additional channel, tone call signal, noise squelch control, circuit contains 12 transistors, diode and thermistor. Transmitter stability crystal controlled .005 . Aerial 13 section telescopic. Powered by 8 1.5v UM3 batteries. Range up to 10 miles depending on conditions. Size 8½in by 3½ x 2in. Price $39.50 per unit.

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PRODUCT REVIEWS AND RELEASES

Harman Kardon four-channel receiver

With the variety of different techniques of quadraphonic recording, it is difficult to make a decision when buying equipment. One answer is the Harman Kardon 75 + 4-channel receiver. It has high power and flexibility to reproduce 4-channel sound from a number of sources. It was submitted for review by Jervis Australia Pty Ltd.

Presentation of the Harman Kardon 75+ is large and impressive. Dimensions are 430 x 400 x 135mm (Wx D x H), including knobs and feet. The control panel is aluminium with a "scratch-grain" finish and the tuner dial is black, lighting up in green when wither of the tuners, AM or FM, is elected. For all its facilities, the control line-up is relatively uncomplicated and not too awe-inspiring. There are nine push-buttons, six knobs, two headphone jack sockets and a joystick control for side-to-side and front-to-back balance.

On the rear panel is an array of phono sockets for connection of both two channel and four channel sources. Screw connections are provided for up to eight loudspeaker systems. There are five fuses, and a plastic-sheathed ferrite rod aerial which can be oriented for optimum radio reception.

Removal of the cover reveals without a doubt that the unit is made in Japan. This is confirmed by the "Made in Japan" legend on the rear panel. In spite of the complexity of the receiver, the layout is very neat inside, with no less than twelve printed boards. The tuning knob has flywheel assistance and there is a complicated dial string arrangement for the AM-FM tuning gang.

There are two separate power transformers in the unit, so that left and right channels are completely separate as far as power supply is concerned. Balanced positive and negative supply rails are used so that there is no need for output coupling capacitors. This means that the loudspeaker damping factor is high and power output is maintained at low frequencies, In addition, it means that regardless of the mains input voltage, the amplifiers should always clip symmetrically and thus deliver maximum power.

Tone controls are provided for front and back channels although this facility is not normally provided on the rear channels. It must be quite expensive to provide this facility too, when one considers that not only is extra circuitry required but the potentiometers are expensive 4-section ganged-concentric types.

In use, all controls function smoothly and positively. We particularly liked the "joystick" balance control. It uses four potentiometers which are linked together in a very simple mechanical arrangement. It enables a full range of adjustment of all four channels and is a much more convenient arrangement than having a number of separate slider or rotary controls.

AM radio reception is good although the tuner is by no means a wide-bandwidth unit. It does suffer to some extent from cross-modulation but this tends to be a nasty problem with most solid state tuners. The adjustable ferrite rod aerial is a good idea since it can be oriented for best reception without having to move the receiver about.

SQ decoding is provided in the receiver and it has inputs for discrete four-channel sources such as tape or future CD-4 adaptors. The unit can be used as a conventional four-channel amplifier, or as a double-stereo amplifier with sets of loudspeakers in different rooms. In this application, the tone control facility on the rear channels is handy for independent tone adjustment to suit different sets of loudspeakers.

As a bonus, the unit can be operated in "bridge" mode so that the back and front amplifiers drive common loads. This means that the user effectively has a stereo amplifier with twice the power rating of a single channel. No matter what mode of operation we used we found the unit always quiet and with plenty of power in reserve.

Power ratings for the 75+ are conservative. For four-channel operation, it is rated at 18 watts continuous into 8 ohm loads, with all channels driven. Power bandwidth is 20Hz to 20kHz for 0.7pc total harmonic distortion. For the "double-stereo" mode (bridge operation) it is rated at 45 watts continuous into 8 ohm loads with both channels driven.

We were able to measure power in excess of all the ratings. For 8-ohm loads, with four channels driven, power output was 24 watts continuous; for 4-ohm loads, power was 18 watts continuous; for 16-ohm loads, 16 watts continuous. At 20 watts into 8-ohm loads, harmonic distortion was less than 0.2pc for frequencies in the audio range and at low power levels it was reduced, although not substantially.

In the high power stereo mode, power was 50 watts continuous with both channels driven. All these measurements were performed with the unit set for 240VAC operation.

Phono cartridge overload was quoted at 75mV (no frequency mentioned) but we measured it at 60mV RMS at 1kHz, which is adequate for most cartridges. Signal-to-noise ratio with respect to full power into 8 ohm loads was better than 63dB for phono input, improving to better than 73dB for high level inputs.

Separation between left and right channels was excellent, as could be expected, at better than 60dB over the whole audio range. Frequency response was phenomenal at +1dB from 10Hz to 100kHz at the 1 watt power level. This is really of academic interest only, however, as it is far better than it needs to be. As can be imagined, square wave response was excellent. Stability with capacitances shunting the loads was also okay. RIAA equalisation was also right on the button with less than 1dB deviation from the ideal characteristic.

In summary, the Harman Kardon 75+ is an impeccable performer with loads of power and plenty of operating convenience and flexibility. It would appear to be well worth the recommended retail price of $599.00.

Further information on Harman Kardon equipment can be obtained from high fidelity equipment retailers or the Australian distributors, Jervis Australia Pty Ltd, 111 Old Pittwater Road, Brookvale, NSW. (L.D.S.)

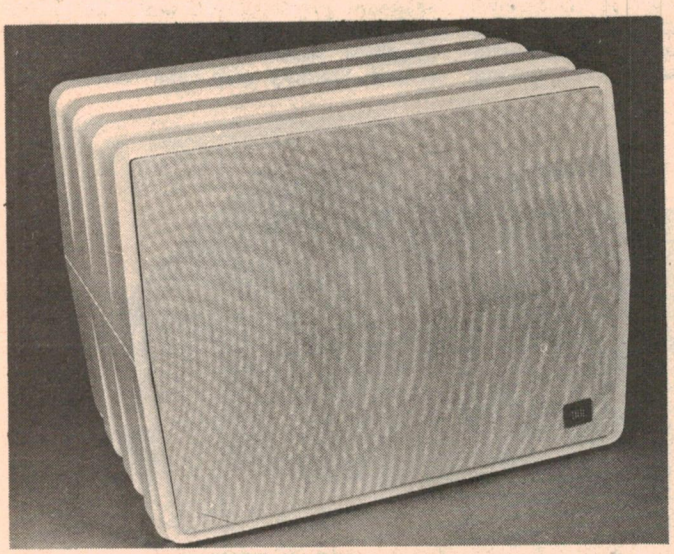
NEW PRODUCTS

JBL Prima 25 loudspeaker

Prima 25 made by James B. Lansing Sound Inc is the world's first large loudspeaker system with a moulded thermoplastic enclosure. It is a two-way system with a 25cm woofer and 3.5cm tweeter and has a power handling capability of 35 watts on music signals. It was submitted for review by Jervis Australia Pty Ltd.

One is immediately aware of the major feature of the Prima 25 loudspeaker system — that its enclosure is a thermoplastic moulding. Actually it is moulded in two parts which are joined by an epoxy resin. The moulding is ribbed inside and out to give extra rigidity, and incorporates a moulded-in cleat at the front to mount the baffle-board.

We gather there are two reasons why a plastic enclosure has been developed. One is to provide a new, flexible medium for the stylist which releases him from the constraints of timber cabinetry and avoids the shortage of high-quality timber veneers. The second is that plastic is a material which lends itself easily to precision mass-production techniques.



Plastic mouldings tend to screech "Cheap, cheap!" but this is not the case with this moulding — it is heavy, rigid and non-resonant. As a bonus, its finish is not easily marred and is washable, which is an advantage over the usual highly polished or oiled timber cabinet.

Low frequencies are produced by a 25cm woofer with a large magnet and spider assembly. The voice coil is 5cm in diameter. The word to describe the woofer is "massive," from the diecast chassis to the heavily ribbed cone with its large roll surround. It covers the range up to 2kHz and would appear to be capable of high power operation.

The enclosure is tuned at low frequencies by a 7cm diameter tunnel which is bent inside the enclosure so that it is closely coupled to the woofer. Acoustic damping material lines the inside of the enclosure to reduce the effect of standing waves.

From 2kHz upwards, signals are reproduced by the 3.5 cm diameter tweeter. Contrary to the trend nowadays with high-power loudspeaker systems, it is not a dome unit but has a conventional cone with a 16 mm diameter voice coil — which is large in comparison to the cone diameter. Again, to assure high power handling capability, it has a large magnet weighing approximately 720g. The cone of the tweeter has a dense foam surround to reduce unwanted radiation and reflections.

A crossover network consisting of two iron-cored inductors, a capacitor and a wirewound attenuator splits up the signals to woofer and tweeter. The attenuator has a large range of control over the tweeter volume level but no instructions on its use accompany the loudspeaker system apart from the comment: "Adjust for most pleasing balance."

As intimated already, the forte of JBL loudspeaker systems is their power handling capability, and in this respect the Prima 25 is well endowed. The manufacturers state that it can be used safely with amplifiers capable of delivering up to 60 watts continuous per channel. It may be thought that the power handling capability is gained at the expense of efficiency, but this is not the case. As we have found with other JBL systems reviewed in the past, the Prima is efficient compared to most modern loudspeaker systems, and can deliver really shatteringly loud sound levels. In this respect, it is more than adequate.

On sine wave tests with a high quality amplifier we found the woofer output strongly maintained down to below 40Hz but with noticeable resonances at around 80Hz and 40Hz. By way of explanation, these "resonances" are characterised not so much by an increase in acoustic output but by a rise in pitch, ie, they are manifest as "frequency doubling" from 40Hz to 80Hz or from 80Hz to 160Hz, as the case may be.

In the midrange frequencies we found strong peaks at about 2.5kHz and 4kHz. The lower peak seemed to be produced by the woofer while the upper peak was produced by the tweeter and could be controlled to some extent by the attenuator. These peaks will tend to add an element of harshness to stringed instruments such as violins, but will be less of a problem with "pop" material, in fact it may tend to add to the presentation of such program material. Higher up in the range, the tweeter is strong to about 10kHz and tapering beyond that. Treble dispersion is good, which is to be expected with a "point source."

In reviewing this type of equipment, we have to take into account the market for which it is intended. That market, as we see it, is among the "trendies" — people who listen to the latest in pop artists and require plenty of clean, power handling capability. In addition, their equipment needs to be rugged and forgiving in terms of knocks to the cabinet and possible overload.

In this respect, the Prima is well suited. It has a trendy, easily maintained finish and rugged loudspeakers. On pop music, it delivers the sound that these people want to hear. On classical music, its performance could be tiring. Doubtless JBL have loudspeaker systems more suitable for this application.

The Prima 25 is available in cabinet colours of Yellow, Red-Orange, Brown, Blue, Charcoal and White and with grilles colour keyed to the cabinet. As a bonus, a matching record storage module is available in the same colours. Recommended retail price of the Prima 25 is $450 a pair and the record storage modules are $75 each.

Further information can be obtained from retailers of JBL equipment or from the Australian distributors, Jervis Australia Pty Ltd, 111 Old Pittwater Road, Brookvale, NSW 2100. (L.D.S.)

High-quality Headphones from Sonab

Over the last eighteen months or so, Sonab of Sweden have gradually introduced a line of products aimed at the "quality" end of the hi fi market. Now they are introducing two stereo headphones, the H10 and H20. We reviewed the H20 and found them to have very wide-range sound.

Sonab headphones do not have the rather "jazzy" styling of many headphones but are designed with unobtrusive looks and are simple mechanically. The headband is a 2.5cm wide strip of nickel-plated springy steel which is padded. The earpieces slide up and down the headband and also swivel in their holders to suit the listener's head. In this respect, they are a welcome development from the rather fiddley earpiece mounting arrangements of some headphones.

The earpieces are unambiguously marked "L" or "R" as the case may be, so there is no confusion in this respect. The ear surrounds are comfortably padded with soft foam and they are easily removable for occasional washing or replacement. The coiled cord is light and very flexible and requires almost no tension at all to stretch it. This is a big advantage as it means that the cord will not pull the headset off the listener's head if he strays a little way from the amplifier. Overall finish of the headset is matt black, which matches the colour of Sonab amplifiers and turntables.

Weight of the headset not including the cord is a reasonably light 450 grams, which makes for fatigue-free listening.

Normally, most headphones use a small loudspeaker in each earpiece as a driver, but in the Sonab H20 the drivers are very similar in construction to the latest type of plastic dome-tweeters rather than conventional miniature loudspeakers. This probably explains the wider frequency range claimed for these phones.

Nominal impedance of the phones is 400 ohms per channel. While this figure is much higher than the accustomed 8 ohm impedance of most headphones, the H20's are still compatible with the headphone jack socket found on most amplifiers these days.

Listening to the H20's with continuous tones we were able to verify that the frequency response is very wide and in fact as wide as the best headphones we have tested. It would appear to be very smooth up to 15kHz and taper slowly beyond that. Midrange is again very smooth while the bass is well maintained, without being dramatic, down to around 50Hz.

On music listening tests we were immediately impressed that this is indeed a wide-range headphone because surface crackle and hiss were immediately apparent and obtrusive — this is not normally the case with most headphones. However, a little treble cut with the amplifier's tone controls corrects this without unduly affecting the overall balance.

At the bass end, boost can be applied on most records and most people would use the H20's in this way, to complement the extended high-frequency response and to compensate for possible inefficiency of the seal around the ears — after all, you cannot have them on too tightly.

Overall, clarity is the word which can best describe the Sonab H20's. They have very little colouration and can provide hours of fatigue-free listening. Listening comfort is good although the headband padding could be a little softer. As it is, the padding is a little like the crash-padding on some automobile dashboards.

Sonab H20 stereo headphones.

Recommended retail price of the Sonab H20 is $45 while the H10 model is $35. Sonab equipment is available from retailers of high-fidelity equipment throughout Australia. Further information can be obtained from Sonab of Sweden Pty Ltd, 114 Walker Street, North Sydney, NSW 2060. (L.D.S.)

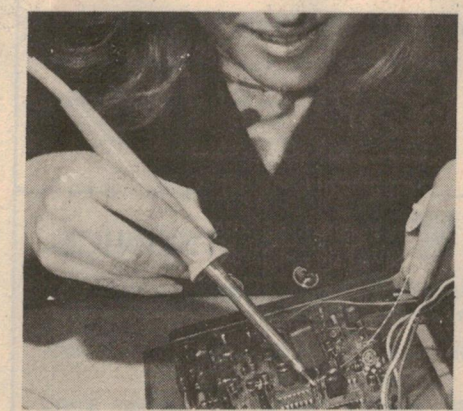
Controlled temperature soldering iron

A new series of line voltage soldering tools featuring temperature control by "electronic feedback" has now been released by Adcola Products Pty Ltd. A wide range of accessories for the new tools has also been made available.

Called the "Thermatic" series, the new tools have a temperature range which is infinitely variable between 200 and 400 degrees. The tip face temperature is altered by simply adjusting the in-handle selector. Temperature variation is achieved within a matter of seconds, thus enabling the one tool to handle joints of differing thermal appetites.

Since the element is electronically switched off when the tip reaches the selected temperature, the new soldering tool incorporates larger than normal heating elements so that heat-up and heat recovery times are kept at a minimum. The all solid state sensing and switching circuitry is contained within the handle.

Tip-face size and profile can be selected from Adcola's range of twelve standard tip sizes. All tips are fitted with anti-seize ferrules, and tip seizure is claimed to be a thing of the past. In addition, the temperature selector can be fixed (if required) to prevent unauthorised adjustment, and a new tool rest, complete with tip wiping sponge, provides protection for the tool and convenience for the operator.



For further information contact Adcola Products Pty Ltd, 22 Firth St, Doncaster, Victoria, 3108.

An addition to the [illegible] the Model [illegible] has been int[illegible]nics Incorpor[illegible]on.

This versatile new function generator offers new capabilities in pulse, sweep and transmission line testing, and is capable of producing high quality waveforms throughout its frequency range. The instrument is essentially two waveform generators in one, a main generator and a 100nS to 1,000 second ramp/pulse generator. It can produce sine, square, triangle, ramp, pulse and sync waveforms with pulse widths variable from 25nS to 1,000S, and at repetition rates from 0.0001Hz to 20Mhz.

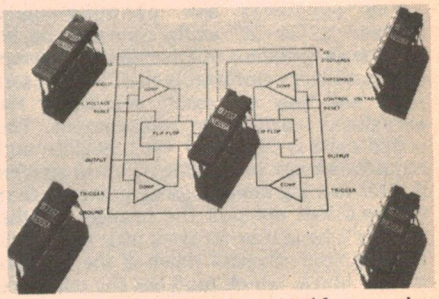
For further information contact Jacoby, Mitchell Ltd, 215 North Rocks Road, North Rocks, NSW 2151.

NEW PRODUCTS

Dual solid-state timer for $US1.25

A dual electronic timer in the form of a monolithic integrated circuit has been designed and developed by the Signetics Corporation.

The NE / SE 556 dual timer is capable of producing fully controllable time delays between one microsecond and one hour. Both halves of the timer are capable of independent operation, and timing is adjustable over a ratio of ten to one. The dual timer can also be connected to run free, in which case each half can be set to oscillate at any frequency between 300kHz and less than one pulse per hour.



Intended for use in a wide ranging number of systems, including automobiles, home, appliances, industrial control systems, and sophisticated electronic equipment (such as data systems) the NE / SE556 is suitable for such applications as simple time delay, time sequencing, pulse generation, missing-pulse detection, frequency division, pulse-width modulation, and pulse-position modulation.

New PA range

The Plessey Company has recently announced the release of a new range of Australian designed and manufactured public address amplifiers.

The portable versions of the new range are available in two basic sizes; a 35 watt version and a 100 watt version. Both versions have provision for a number of different facilities by using various optional input modules. The extra input modules can be used for additional microphones, or such

options as background music, tape decks, record players, or radio tuners.

In addition, an automatic muting device can be fitted so that a background music system is automatically muted whenever the microphone is used.

For further information contact Plessey Communication Systems Pty Ltd, 87 Racecourse Road, North Melbourne.

Audiosound Motette: big value in a small package

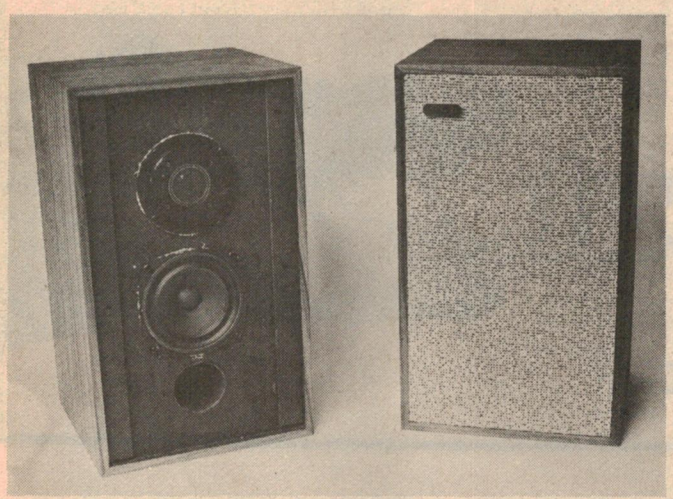
Audiosound Electronic Services are one of the few local manufacturers of high-fidelity equipment. They have a comprehensive range of sound equipment that includes a stereo amplifier, loudspeakers and a high quality AM tuner. In this review we test one of the smaller units in their range, the Motette II loudspeaker system.

It is now almost ten years since that revolutionary loudspeaker system, the Goodmans Maxim, was introduced. It was the first really compact loudspeaker system to produce reasonable bass output below 100Hz. Since then there have been many compact loudspeaker systems produced, but there is still fascination among the hifi fraternity in being able to obtain a gallon of bass from a quart enclosure. Perhaps I should have used metric units here.

Although large compared with the Maxim, the Audiosound Motette II is still a compact unit measuring 218 x 371 x 200mm (W x H x D). It has a 2.5mm dome tweeter with a large ferrite magnet, and small woofer with roll surround and an effective cone diameter of only 70mm. It must be one of the few woofers ever produced with a magnet larger in diameter than the cone.

Coupling the two loudspeakers to the signal is a carefully designed 5-element crossover network consisting of an air-cored inductor, 2 polyester capacitors and two wirewound resistors. All these components should give no problems as far as reliability is concerned.

Low frequency performance of the enclosure is augmented by a 50mm diameter tuned tunnel. The enclosure itself is very ruggedly constructed from veneered particleboard, and is airtight with non-hardening sealing compound around the loudspeaker units. Inside, padding is used to break up standing waves between the parallel sides of the enclosure.



At left, the Audiosound Motette II 2-way loudspeaker enclosure. In spite of the small woofer, it will handle signals from amplifiers with ratings up to 40 watts.

Grille cloth is an acrylic scrim material attached to a frame which is a neat push-fit into the front of the enclosure. Acrylic scrim is an excellent choice for grille cloth — not only is it acoustically transparent but is easily replaceable if it is damaged inadvertently.

Tested with a sine wave oscillator and high power amplifier we found the frequency response of the Motette II system to be very smooth and without any noticeable peaks or troughs. Tweeter output was very well maintained to the upper limits of audibility and beyond. By comparison, the bass was a little weak but still well maintained down to below 50Hz.

On music signals, the Motette II gives a particularly good account of itself, expecially when its size is taken into account. It needs to be driven by an amplifier capable of at least 20 watts into 8 ohms (the nominal impedance) and can handle the output of amplifiers up to 40 watts. Bass boost is unnecessary with most program material but judicious bass boost can be used — too much and the loudspeaker overloads.

If any complaint is to be made about the sound quality and balance, it is that the tweeter level is just a little too high and perhaps could be attenuated slightly. Doubtless, Audiosound have experimented along these lines and decided on the best compromise. Overall, it can produce some staggeringly loud and really excellent sound. I suspect that overseas manufacturers would put on a fancier grille and double the price.

Summing up, the Audiosound Motette II is the obvious choice in loudspeaker systems where space and decor dictate a compact unit. At the same time, it gives high quality sound that gives nothing away to much larger and more expensive systems.

Recommended retail price is $112 a pair, and enquiries should be made direct to Audisound Electronic Services, 148 Pitt Road, Curl Curl, NSW 2096. (L.D.S.)

Push button switch kit for prototypes

Prototype push button switches can now be made cheaply and quickly by using a switch kit which has been produced specially for designers of electrical appliances and electronic equipment.

Known as the Isostat Engineers Prototype Switch Kit, each kit contains eighty switch modules with push on/push off action, interlock (where pressing a button cancels the previous button), and momentary functions. Sixty mounting brackets for making one to 19 position switch banks are supplied. These have switch pitches of 10,15, 17.5 and 20mm. Matching latch bars are provided for the interlock function.

Switch buttons in five styles, both illuminated and plain, are supplied. There are 125 plain buttons in red, grey, black and white and 16 illuminated buttons in clear, red, pink and green. Full assembly instructions, parts list and part numbers are supplied with each kit.

Further information is available from McMurdo (Aust) Pty Ltd, 19 Carinish Road, Clayton, Victoria, 3168.

Digital receiver

A new full-facility digital display communications reveiver has recently been released by Eddystone Radio.

Designated the EC958/7, the new unit incorporates all the facilities of the standard EC958, although many of he operating parameters have been improved. It provides frequency coverage from 10kHz to 40MHz in a continuous sweep which, coupled with its frequency stability and rugged construction, makes it well suited for a wide range of applications in fixed, mobile and maritime services.

Using only the main tuning control and range switch, the EC958/7 can be continuously tuned over the entire frequency range. Operation in the high frequency bands above 1.6MHz is normally in the high-stability mode. In this mode, the main tuning control is used to select the nearest 100kHz point. A narrow band-width, drift-cancelling loop locks to an internal 1MHz master oscillator at 100kHz points. An incremental control tunes the receiver between two 100kHz points with a resolution of one Hertz.

NEW PRODUCTS

High performance UHF mobile two-way radio

Philips Telecommunications has released a new high performance UHF mobile two-way radio unit.

Designated the FM747, the new two-way radio system features an adjustable mute circuit and a special high frequency IF stage to ensure maximum range, minimum signal flutter and chopping, and minimum interference. An internal microphone gain control allows adjustment for different operational conditions. The output power of the audio amplifier (3W) provides ample volume to cope with the noise in all industrial type vehicles.

Available in a variety of models to suit differing requirements, the FM747 can be supplied with a wide range of options. These

include: single channel, six channel, or 10 channel models; fist microphone with separate high efficiency speaker; and a telephone handset.

In addition, the unit includes several circuits to protect it from inadvertent damage or mishandling. These include "in-line" fuses, non-destructive polarity protection against incorrect connection to a battery, overload and short circuit protection, and aerial mismatch protection. A special red LED on the front panel indicates that power is being delivered to the aerial, and serves as a warning device in case of transmission failure.

The unit has been designed to ensure maximum driver safety, both from the operational and the physical contact point of view. Fingertip controls allow for easy operation without driver distraction, and the controls are recessed behind a shock absorbent panel surround.

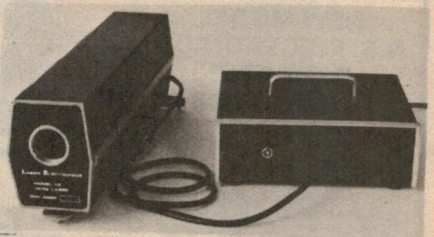
For further information contact Philips Telecommunications Manufacturing Company Ltd, PO Box 105 Clayton, Victoria.

Low cost laser tube from Laser Electronics

A new low cost, long-life laser tube has recently been placed on the market by Laser Electronics. Rated at 0.5mW, the new tube is highly suitable for educational purposes and general experimentation.

The new tube, designated type CW-50, replaces the EOA 9040 tube which proved to be very popular as a result of an article, detailing the construction of a helium-neon laser, presented in this magazine some time ago.

The CW-50 tube is priced at a very competitive $52.00 (plus sales tax). Circuit diagrams and associated electronic components may be purchased separately.



Not the CW-50 tube, but a small late-model laser marketed by Laser Electronics.

For further information contact Laser Electronics Pty Ltd, PO Box 359, Southport, Queensland. 4215. Telephone 32-1699.

NEW PRODUCTS

New range of miniature coils

A welcome addition to the field of coil manufacturers is Transcap Pty Ltd, who have just announced a series of miniature coils for use in transistor receivers as well as some other applications.

One set consists of coils in ¾in square cans. Available types are for use as aerial, 1st and 2nd RF bandpass, osicllator, 455kHz interstage coupling and 455kHz detector matching IF transformers. Type Nos are 7155, 7210, 7211, 7348, 9185 and 9186, respectively. Each unit is terminated such that it will be a direct replacement for coils already on the market. Another coil which also is part of the above set is a loopstick aerial coil, type No 7154.

A whistle filter coil is also available, slug variable about 10.7mH and fitted in a ¾in x ¾in square can. Used in a bridged T network, the coil will tune to 10kHz with two .047uF capacitors in series.

Inductors for loudspeaker crossover networks are available in inductances of 0.5mH, 1mH, ¼.⅝MH and 6mH. These inductors are wound "on air," with a heavy gauge of wire.

All the above items are distributed by Watkin Wynne Pty Ltd, 32 Falcon Street, Crows Nest, NSW 2065 and they should be available throughout Australia from all components stockists.

Replacement for silicone grease

A new thermal conducting compound providing greater heat transfer efficiency than silicone grease is currently being marketed by Field Group Chemicals Pty Ltd.

Known as "TRANZ Q413," the new heat transfer compound was developed in the laboratories of Field Group Research Pty Ltd who claim that it has a thermal conductivity of approximately 4.25 times that of silicone grease. In addition, the company claims that TRANZ Q413 is less expensive than other imported materials, has superioe long-term stability characteristics, prevents oxidation of heat transfer surfaces (and consequent increases in resistance) and is a good electrical insulator.

For further inquiries contact Field Group Chemicals Pty Ltd, 17 Dickson Avenue, Artarmon, NSW 2064. Telephone 439-5911.

New catalogue from Kit-Sets Australia

A new electronic component and equipment catalogue has recently been published by Kit-Sets Australia Pty Ltd.

Containing over 100 pages, the new catalogue provides the latest information on electronic components, projects, kits, test equipment, tools, servicing aids, and accessories. A 24 page Hi-Fi supplement in the centre of the manual lists the price details and specifications of some of the latest commercially available stereo amplifiers, tuners, turntables, speakers, and associated equipment.

In addition, the new catalogue gives a brief description of some of the latest and most popular magazine projects. These projects include the latest "Playmaster" series of audio amplifiers and tuners, together with details on communications receivers and test equipment.

The quality and overall presentation of the catalogue is of a high standard, and at 65 cents (plus 25 cents postage) it represents excellent value.

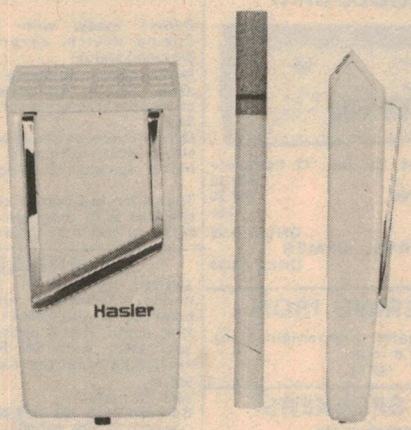
For further information contact Kit-Sets Australia Pty Ltd, PO Box 176, Dee Why, NSW 2099. Telephone 982-7500.

Interference free radio paging

Radio paging has gained widespread acceptance as an important aid to internal plant, office, and warehouse communications.

The Plessey Hasler Inductive Loop Radio Paging System can be installed in city buildings without interference to similar systems in adjacent buildings. Even systems on separate floors of the same building can operate efficiently with absolutely no interference.

Each mobile staff member carries a miniature receiver which emits a discreet, yet distinctive, "beep" signal. The system can be made up of any number of receivers to suit any requirement.



AMATEUR BAND NEWS & NOTES

by Pierce Healy, VK2APQ

The Moree Satellite Earth Station

Although satellites and their associated terrestrial communication centres are now commonplace, the technical knowhow employed has an irresistible attraction for most amateurs.

Such was the case when the opportunity arose to visit the Moree Satellite Earth Station a few months ago. Amateurs visiting areas where such centres are located, generally off the beaten track, should make prior arrangements with the appropriate authority or organisation to inspect these installations.

Although that was done, unexpectedly the visit coincided with a "critical coverage" period associated with the Skylab project and a full inspection of the equipment was not possible.

However, an hour spent with Mr Phil Harris, the station manager, together with copious equipment notes he generously supplied, more than satisfied the desire to know something of the technical aspects of the station.

Space does not permit all the technical details to be given, but the following is a summary of some of the interesting points.

First, here is a very simplified explanation of the system.

The combination of a geo-stationary satellite and earth station can be likened to a terrestial radio station with a beam antenna some 35,000 kilometres high. But instead of a mast carrying the feedline and supporting the antenna, which is impracticable, SHF radio links are used between the antenna (satellite) and transceiver (earth station).

The advantage is that one antenna (satellite) can cover one third of the earth's surface and transmissions are not affected by normal propagation variations.

The Moree Satellite Earth Station is owned by the Overseas Telecommunication Commission (Aust). It is located in Garah Road, Moree, northern NSW, about seven miles from the township.

Its purpose is to provide Australian Commerical Satellite communication with Pacific / Asian areas via the Pacific Intelsat Satellite, "IS4."

The Intelsat 4 carries 12 transponders, 6 antennae and associated power supplies. The satellite accepts earth stations' carriers in the spectrum 5.9-6.4GHz and retransmits in the range 3.7-4.2GHz.

There is provision for switching transponders to various antennae.

Antenna—Moree:

The main reflector is a parabola 27.4 metres in diameter. A sub-reflector 2.1 metres in diameter, is mounted on a quadripod on the main dish and reflects radio frequency energy between the dish and the feed horn, mounted on a cone-shaped structure in the centre of the main dish. The system is known as a Cassegrain fed radiator.

The sub-reflector is mounted on a rotating shaft, slightly offset from its centre. This is the basis of the tracking system, known as conical scan or con-scan. Any change in signal level as the reflector rotates is indicative of an aerial direction error and activates a servo controlled hydraulic drive system which corrects the error.

The antenna uplink gain is approximately 63dB at 6.175GHz, and the downlink 60.2dB at 4.058GHz. The system can automatically track in winds of 96.5 kilometres per hour, gusting to 120.7 kilometres per hour. Rainfall tolerance is up to 50 millimetres per hour.

Receiver:

The first stage following the antenna feed is a parametric amplifier, with a bandwidth of 500MHz and capable of receiving a number of discrete carriers. The parametric amplifier, which is duplicated, is cooled to approximately 20 degrees Kelvin by a two stage refrigerator. It is situated in the feed cone to reduce the feed noise prior to the next amplifier.

The parametric amplifier is a four stage varactor diode followed by a tunnel diode stage giving a gain of 40dB. The pump signal is provided by a reflex klystron operating at 37.1GHz of maximum power output of 750mW.

In the feedcone adjacent to the parametric amplifier is a 4GHz solid state amplifier with a gain of approximately 30dB over the band. It amplifies the 4GHz signals beforethey are sent by wave guide to the main equipment room.

Following the solid state amplifier a Travelling Wave Tube (TWT) amplifier transmits the broadband signals by waveguide to a carrier splitting network of circulators and filters in the main equipment room. From this point onward each carrier is down converted to a 70MHz IF and then demodulated in conventional FM demodulators or phase locked demodulators.

The signal is then multiplexed for transmission by terrestrial circuits to Sydney.

Transmit system:

Communication traffic received from Sydney is fed to the terrestial and space multiplex equipment, where it is assembled for transmission to the satellite.

The transmitter system consists of a number of separate FM modulators which are followed by up converters forming separate multi destination carriers on various frequencies throughout the 500MHz bandwidth.

The carriers are then multiplexed and fed to an intermediate power amplifier and a high power amplifier which contains a Varian tube with 500MHz bandwidth. The final tube is water-cooled through heat exchangers at the base of the antenna tower. In conjunction with the system antenna gain of 61.1dB the transmitting system is capable of 98dBw at 6GHz.

Building and power services:

The building is in a prefabricated modular form to allow for expansion. The site can accommodate at least another four antennas.

Commercial power supplies are used and there is an auto start 500KVA diesel alternator for emergency use. As much as possible of the equipment is operated from a DC supply obtained from a rectifier-battery system, to minimise difficulties due to mains supply interruptions.

All monitoring and control for the station can be carried out from the central location in the main equipment room.

A considerable amount of standby equipment is provided for most of the equipment in operation. Comprehensive switching of transmjt and receive equipment is achieved by coaxial or waveguide switches as the case may be.

Patching facilities are provided at the intermediate frequency points in both transmit and receive directions.

In addition to the communication channels provided for commercial use, a number of engineering service circuits are provided. These circuits permit technical communication either by voice ot teletype, between earth stations. Television circuits are provided on a demand basis.

Incoming and outgoing traffic handled by the Moree Satellite Earth Station is passed through the OTC Aust. International Testing and Maintenance Centre, Sydney, NSW. Australian Post Office microwave links and coaxial cables are used to link Sydney with Moree.

Thanks to Mr Phil Harris it was a very rewarding visit. His help in providing a wealth of information is appreciated. This very condensed version may answer a few questions about the station, but more likely raise a greater number; particularly from amateurs who experience that irresistible attraction towards present day radio communication systems. Systems that it can truly be said had their beginnings in "Amateur Radio."

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent direct to Pierce Healy at 69 Taylor Street, Bankstown, 2200.

1296MHz E-M-E WORLD RECORD

A 1296MHz moonbounce world record was set at 0357GMT on October 6, 1973. The path was from Geelong, Victoria to Middletown, New Jersey. It was also the first two-way contact between Australia and the United States on 1296MHz. The distance; around 500,000 miles or 804,700 kilometres. The mode: CW.

The paricipants were Ron Wilkinson, VK3AKC and W2NFA, the Crawford Hill VHF club station operated by Bob Buus, WA2HVA, Dick Turrin, W2IMU and Tony Rustako, K2KII.

A QSL of the contact has been received by Ron. Signal reports were — VK3AKC readability 5, strength 4, tone 9. W2NFA was readibility 5, strength 5, tone 9. Ron also reported that from 0340GMT to 0512GMT on the day of the test, signals from W2NFA were readable 5 for more than 90 per cent of the time.

The attenuation path of the E-M-E contact is calculated at 294dB. During the test the moon was not visible at Geelong due to cloud. Bearings were set using elevation and azimuth readouts of the moon's position supplied by the US Navy.

Some details of the equipment used:—

VK3AKC —

Antenna: 6.1 metre dish with 36dB gain and beam width of 3 degrees.

Receiver: Two NEC1336 transistors into a mixer cavity at 144MHz IF located at the antenna feed horn, fed to a 28MHz IF into a FT200 receiver and audio filter.

Transmitter: A pair of 3CX100A5's in grounded grid. 150 watt DC input.

All the equipment, except the FT200 receiver, was home built.

W2NFA:

Antenna: 18.3 metre dish circular polarised feed.

Receiver: Transistor pre-amp using a MT4000 to a pair of V766's.

Transmitter: Modified UPX / 4, ring amplifier using six 7289 tubes. Power output 500 watts.

A high power permit of 500 watts has been granted to Ron for future tests. This is for E-M-E tests only and is renewed on a 12 monthly basis.

A few months ago Ron copied CW signals from OZ9CR in Denmark for about one minute. The group at W2NFA were surprised that Ron operated his station single handed, whereas they used at least four operators to assist in tracking and operating the equipment.

Special thanks have been expressed by Ron for the assistance received which made the achievement possible. Those mentioned were: Varian Pty Ltd for the tubes used in the transmitter, the US Navy for moon elevation and azimuth readouts, also for the transistors used in his receiver. Crawford Hill VHF group for supplying technical data and Trevor Niven VK5NC ex VK5ZTN who machined the ring amplifier used in the VK3AKC transmitter.

144MHz E-M-E CONTACTS

There have been two recent overseas contacts on 144MHz using moonbounce techniques. One was by Ray Naughton, VK3ATN, of Birchip, Victoria, and the other was by Chris Skeer, VK5MC, at Hatherliegh, 72 kilometres north west of Mt Gambia, SA.

A special signal report code system is used for E-M-E (Earth-Moon-Earth) contacts, as follows:

"T" denotes odd letters copied.

"M" denotes most letters copied.

"O" denotes all letters copied.

On October 15, Ray, VK3ATN, worked Bob, W6PO, in California, and Don, VE2DFO, in Quebec. Ray again made contact with these two stations on October 16. The contacts were made in CW and the signal reports were "O". No other details are available at the time of writing.

On October 16 Chris, VK5MC, also made contact with W6PO and VE2DFO. The contact was two-way, CW, and the reports exchanged both ways were "0".

On Wednesday, October 17, Chris contacted both stations again with the same reports exchanged. In addition he heard KH6NS with a signal report of "M." An SSB signal was also heard, but was unreadable due to Doppler shift.

The longest time over which contact was maintained was 35 minutes, this also being the longest time Chris has achieved. This time is determined by the radiation angle of the antenna (10 degrees) and was the result of recent improvements to the antenna.

Details of VK5MC equipment:

Antenna: Two stacked rhombics, 209 metres long, 9 metres high. To reduce feedline losses Chris built a

new operating shack at the end of the antenna.

Receiver: A preamp with a noise figure of 1.3dB at 144MHz, using a U310 transistor in grounded gate configuration at the end of the feedline. The output is fed into an FR100B receiver with a 60Hz mechanical filter.

Transmitter: Four CX150 running 150W DC input

Chris is approximately 258 kilometres south west of Ray Naughton, VK3ATN, with whom contacts on 144MHz via E-M-E have been made. Chris is a lone operator, but has been helped in the construction of his equipment by Trevor Niven, VK5NC, ex VK5ZPN.

The longest E-M-E contact to date on 144MHz was between SM7BA, Sweden and ZL1AZR, New Zealand.

WIRELESS INSTITUTE ACTIVITIES

Remembrance Day Contest

The 1973 Remembrance Day contest was very successful. A total of 709 logs were submitted and gave the WIA federal contest manager, Peter Brown, VK4-PJ, assisted by his wife, many hours of work checking and computing the final scores.

South Australia, VK5 assisted by the VK8 call area, retained the trophy. However, Tasmania, VK7, assisted by VK0 call area, recorded the highest average score for the top six logs and the highest percentage participation by licensees.

State scores and placings:

State	Call area VK	Logs rec'd	Licencees
S. Aust.	5 & 8	154	798
Tas.	7 & 0	67	227
Qld.	4 & 9	127	839
NSW	1 & 2	145	2162
W. Aust.	6	86	516
Vic.	3	92	2012
Percentage participation	Average top 6	Points	Score
19.3	1471	47096	10559
29.5	1615	21582	7985
15.1	1301	35994	6749
6.7	1415	42867	4289
16.6	972	19764	4266
4.5	870	22617	1904

NEW SOUTH WALES

Central Coast Amateur Radio Club

Plans for the popular Central Coast Field Day, Sunday, February 24, 1974, have been finalised. Full details will be included in the February issue of these notes. In the meantime, keep that date free for a visit to Gosford. There will be entertainment for all the family.

There are eleven students for the AOCP classes at the CCARC rooms, Dandaloo Street, Kariong. The classes are held each Saturday afternoon at 1.30 pm. A group of five experienced operators are rostered to provide instruction.

The consensus of opinion, following participation by the club at the 1973 Gosford Show was that, despite all the work involved, and electrical interference from amusement and commercial displays, the effort was worthwhile. Radio 2GO and the two local newspapers gave a good deal of publicity to the club's exhibit. Public interest was also good.

The Central Coast Award is available to amateurs living in or outside the area. Amateurs residing outside the shires of Gosford and Wyong are required to contact the club station VK2AFY and four other Central Coast amateurs.

To apply for the award, copies of log entries together with two postage stamps should be sent to the Awards Manager, PO Box 238, Gosford, NSW 2250.

After verification, a handsome certificate is sent to the applicant.

University NSW Amateur Radio Society

The attention of high school and university students is drawn to the facility being provided by the University of NSW Amateur Radio Society for those wishing to sit for the AOCP examination to be held by the PMG's Department in February, 1974.

Sam Voron, UNSWARS president advises that their study group will commence on Friday, December 14. Three classes will be held each week during the Christmas recess period, on Mondays, Wednesdays and Fridays from 1.00 pm to 3.00 pm and repeated in the evenings from 7.00 pm to 9.00 pm.

No previous knowledge is required. The study group will commence with the basic fundamental principles. Morse code practice will be included for limited licensees wishing to gain the full licence, or to prepare for the introduction of the novice licence.

The study groups will be held, initially, on the ground floor, Shalom College, in the University of NSW grounds, but will shortly move to room 418, 4th floor, Electrical Engineering building. Applications should be sent to the University of NSW Amateur Radio Study Classes, Union Box 57, PO Box 1, Kensington, 2033.

Illawarra Branch

Members of the Illawarra Branch moonbounce group conducted tests on September 30, 1973, with K2UYH, W0EYE and W6FZJ but no signals were heard. It is thought that mail delays, due to industrial trouble, may have prevented details proposing the tests reaching the USA in time.

It was the first test with W0EYE and further tests are planned when the moon is at perigee (closest to earth). It was also hoped to have a visit from W0EYE during a trip to Australia in October.

To obtain information on RTTY for moonbounce purposes, a St George Radio Society meeting was visited to hear a talk on the subject by J. P. Lowe, VK2-ZWL. The group, headed by Lyle Patison, VK2ALU, is anxious to obtain a crystal oven fitted with proportional temperature control to within approximately 0.2 degrees F, so that work on the transmitter frequency source for RTTY can proceed.

Meetings are held on the second Monday of each month, at 7.30 pm, in the Committee Room, Wollongong Town Hall. For details write to the Secretary, Illawarra Branch WIA, PO Box 110, Dapto, NSW 2530.

VICTORIA

Geelong Amateur Radio & TV Club

The Club's "Newsletter", published monthly, contains information on club activities, technical articles, and components available through the club. Subscription is $1.20 per year postage paid. Correspondence should be addressed to — GARC, PO Box 520 Geelong, Vic 3220.

Maintaining good public relations with local authorities is always a good proposition. In Geelong, this has paid dividends.

The Geelong Waterworks and Sewerage Trust have officially advised the Geelong repeater group that the repeater installation, VK3RAG, can remain in their building at Mt Anakie, on a permanent basis. The temporary installation over the past few months has proved the equipment reliable. It is reported to have provided very satisfactory results.

The equipment will be relocated in the building and the power increased from 7 watts to 35 watts. The aerials will also be improved. The changes are expected to improve the range and eliminate some of the "dead" spots.

Geelong Radio & Electronics Society

Among the recent activities of the Society were two excellent lectures combined with demonstrations and application of equipment. Mr Murdock Findlay delivered a very well presented lecture on speaker enclosures. Mr P. Horn, of the Gordon Institute of Technology, explained the operation of computers and demonstrated their use at the GIT premises.

Moorabbin & District Radio Club

At the annual election of officers of the Moorabbin and District Radio Club on Friday, November 16, 1973, only two of the retiring committee of seven stood for re-election.

An active Ladies Auxiliary group organises a high standard of social activities for club members which include picnics, theatre and dinner parties. "APC," the club's monthly news publication, contains technical items of interest.

See club directory for further details.

WESTERN AUSTRALIA

WA VHF Group

It is reported that the 1973 "RD Contest" will go down as the most popular VHF contest in Western Australia. The rule changes permitting repeat contacts after two hours stirred a lot of interest among VHF operators. A check indicated that a total of 37 call signs were operative on two metres FM.

The top VHF only score was in excess of 250 contacts during the 24 hours. Several others topped the 200 mark.

Further donations of equipment for the Wireless Hill museum have been made, including a Zephyr transmitter and associated equipment from the Royal Flying Doctor Society.

The group meets on the fourth Monday evening of each month at the Wireless Hill musuem, entrance from corner of McCallum Crescent and Almondbury Road, Applecross.

10th AUSTRALIAN SCOUT JAMBOREE

On 28th December, 1973, 10,000 Scouts from all states of Australia and several overseas countries, will assemble for ten days at the South Australian Branch Training Centre, "Woodhouse", in the Adelaide Hills.

During this period, the South Australian Scout amateur station, VK5BP, will operate from the jamboree site. Commencing at 0230 GMT on 30th December, 1973, the station will operate 24 hours a day until 1030 GMT on 5th January, 1974.

The station will be equipped with three SSB transceivers covering all HF bands. Two transmitters will operate simultaneously on separate bands while the **third will be on standby in case of breakdown.**

AMATEUR NOTES

Depending on their not being occupied, the basic operating frequencies will be:

1.819MHz	14.190MHz
3.625MHz	21.190MHz
7.050MHz	28.190MHz

Propagation conditions from day to day will determine the two bands in operation.

Three aerial systems will be used:

1. A rotatable quad for 20, 15, and 10 metres.
2. Dipoles at 90 degrees for 80, 40 and 20 metres.
3. Long wire for 160 to 10 metres.

It is hoped that many stations around the world will be contacted from the jamboree site.

TRANS PACIFIC VOYAGE

These notes for May 1973 gave news of the imminent departure of a second expedition to sail by raft from Equador to Australia. The first known successful crossing was made by "La Balsa" in 1970.

The 1973 venture consists of three primitive type rafts, similar to "La Balsa". At the time of compiling these notes, they were south west of Tonga. Their destination is Mooloolaba, on the Queensland coast just north of Brisbane. They were expected to arrive during the first weeks in November.

Amateur radio provides communication with the expedition, each raft being equipped with an SSB HF transceiver. The communication co-ordinator for Australia is Sid Molen, VK2SG. Sid's plans were, at the time of writing, to go to Mooloolaba and maintain contact with the expedition from there during the last week or so of their epic voyage. Also to welcome an old friend, Bital Alsar of "La Balsa" fame, and leader of the expedition.

RADIO CLUB DIRECTORY

Below are details of clubs which availed themselves of this opportunity to publicise their activities. This information is also given as assistance to those planning holidays and may wish to contact amateurs in the areas through which they are passing.

VICTORIA

Name: Moorabbin and District Radio Club.
Club Call Sign: VK3APC
Meeting place: Moorabbin Baseball Rooms, Summit Avenue, Moorabbin.
Date and Time: First and third Friday of each month at 7.45 pm.
Affiliation: WIA, Victorian division.
Contact: David Rosenfield, VK3ADM, secretary, 5 Lygon Street, South Caulfield, 3162.

Name: Eastern and Mountain District Radio Club.
Club Call Sign: VK3ER.
Meeting place: Mooroolbark Technical School, Reay Road, Mooroolbark, Victoria.
Date and Time: Last Friday of each month at 8.00 pm. Also TV group and construction group meet second Friday of each month.
Net frequency: 3665KHz each Monday at 8.00 pm.
Contact: Mr A. Bell, assistant secretary, phone 874 1709. Postal address, PO Box 87 Mitcham, Vic 3132.

Name: Swan Hill District Radio Club.
Club Call sign: VK3BSH.
Meeting place: SHDRC Rooms, Drill Hall, Gray Street, Swan Hill.
Date and time: First and third Wednesday evenings 7.30 pm.
Net Frequency: Channel B 146MHz FM.
Contact: Allen Fountain, VK2YAH, publicity officer, PO Box 682, Swan Hill, Vic 3585.

Name: Geelong Amateur Radio-TV Club.
Club Call sign: VK3ATL / T.
Meeting place: Clubrooms, Storrer Street, East Geelong.
Date & Time: Every Friday at 8.00 pm.
Affiliation: WIA, Victorian division.
Net frequency: Channel 4 repeater VK3RAG.
Contact: Bob Wookey, VK3IC, phone 21 2674. Postal, PO Box 520 Geelong, Vic 3220.

Name: Geelong Radio & Electronics Society.
Club Call Sign: VK3ANR.
Meeting place: Society's Rooms, Belmont Common off Breakwater Road, Geelong.
Date & time: Each Thursday at 8.00 pm.
Affiliation: WIA, Victorian division.
Contact: Bill Erwin, treasurer, phone Geelong 73548 or 97571 (AH).

NEW SOUTH WALES

Name: Central Coast Amateur Radio Club.
Club Call sign: VK2AFY.
Meeting place: Club rooms, Dandaloo Street Kariong, East Gosford.
Tutorial classes: AOCP, Saturday 2.00 pm and 6.00 pm.
Affiliation: WIA, NSW division.
Net frequency: Channel 1 repeater VK2RAG.
Contact: Barry Gibbons, VK2ZUX, phone Gosford 51746. Postal, PO Box 238, Gosford 2250.

Name: Illawarra Branch WIA.
Club call sign: VK2AMW.
Meeting place: Committee room, Town Hall, Crown Street, Wollongong.
Date & Time: 2nd Monday each month, 7.30 pm.
Affiliation: WIA, NSW division.
Net frequencies: 146MHz FM. Channel 1 FM repeater.
Contact: Postal address PO Box 110 Dapto 2530.
Current experiments: 432MHz moonbounce, in conjunction with Wollongong University College.

Name: Marcellin College Radio Club.
Meeting Place: College Club rooms.
Date & Time: Every Monday, 3.30 pm to 5.00 pm and occasional Saturdays 2.00 to 4.00 pm.
Affiliation: YRCS NSW division, WIA.
Contact: Rev Bro Remigius FMS, president, Peter Conolly secretary. Postal address Marist Brothers, Marcellin College, 195 Alison Road, Randwick 2031. Telephone 39 4474, 39 6355.

Name: Maitland Radio Club.
Club call sign: VK2BHV and VK2ZVM.
Meeting place: Club rooms Maize Street East Maitland.
Date and time: Friday evenings 7.30 pm. Classes other evenings and Saturday afternoons.
Contact: Kev Watson, VK2BLW, president. Phone 33 7286, postal address PO Box 54 East Maitland.

Name: Dubbo Amateur Radio Club.
Club call sign: VK2BMA
Meeting place: Police-Citizens Boys Club, Dubbo.
Date and time: Each Friday night 7.30 pm and Sunday morning at 10.00 am.
Contact: Mr. A. Andrews, secretary, 21 Margret Crescent, Dubbo, NSW 2830. Phone Dubbo 82 3574.

Name: University of NSW Amateur Radio Society.
Meeting place: Ground floor, Shalom College, University of NSW, Kensington. Study class room: Room 418, 4th floor, Electrical Engineering Building.
Date and time: Each Wednesday afternoon at 1.00 pm.
Contact: S. Voron, president, 2 Griffith Avenue, East Roseville, NSW 2069. Phone 407 1066.
Society postal address, The University of NSW, Union Box 57, PO Box 1, Kensington, 2033.

QUEENSLAND

Name: Ipswich and District Radio Club.
Club call sign: VK4IO
Meeting place: Club Hall, Deebing Street, Ipswich.
Date and time: Every alternative Tuesday night, 7.30 pm.
Affiliation: WIA, Queensland division.
Net frequency: 146MHz FM (channel B).
Contact: W. Jehn, PO Box 61 Ipswich 4305. Phone 81 3629.

Name: Townsville Amateur Radio Club.
Club call sign: VK4TC.
Meeting place: Civil Defence Headquarters, Green Street, via Sydney Street, West End, Townsville.
Date & time: First Thursday of each month at 8.00 pm.
Affiliation: WIA, Queensland Division.
Net frequencies: Each Sunday 11.00 am on 53.032MHz and 146MHz FM. 7.45 pm on 3.6050MHz.
WICEN nets: 1st Sunday of each month 8.30 am on 7050MHz and 53.032MHz. 3rd Thursday of each month 7.30 pm on 3.6MHz and 53.032MHz.
Contact: Richard Sayers. Phone 79 7422 (B) or 71 5348 (H). Postal, PO Box 964 Townsville, Qld 4810.

ITU NEWS

Mr Richard E. Butler, Deputy Secretary-General of the ITU since 1968, was re-elected to that position at the tenth Plenipotentiary Conference.

When elected in 1968, Mr Butler was Deputy Assistant Director-General of the Australian Post Office. In that position he was advisor for international relations, planning, investments and intergovernmental projects in telecommunications as well as for the national services, including sound broadcasting and television. He took part in many Union conferences and in international negotiations connected with bilateral and multilateral agreements, particularly with regard to space, radiocommunications and submarine cables.

CERTIFICATE HUNTERS CLUB

Since the formation of Chapter 66, International Certificate Hunters Club, announced in the August issue of "Electronics Australia", membership has reached the 40 mark with enquiries still being received — both local and overseas.

As stated then, membership is dependent on merit points. To assist those interested CHC secretary, Jack Gutcher, VK3APU, will supply, on receipt of a self-addressed stamped envelope, details of the main achievement categories and the points for them.

Many Australian amateurs would probably be eligible for associate membership, for which only twelve points are needed. Any fully licensed Australian amateur already possesses a credit of eight points. If he has a certified Morse speed of 15wpm an additional two points is gained, with two points for each additional 5wpm up to 25wpm. Each 5wpm from there on gains three more points. So, a fully licensed amateur with a code speed of 20wpm qualifies for associate membership.

Points are gained for membership of a national amateur radio society — WIA; RSGB; ARRL; NZART; etc, or office in a radio club affiliated with the national body. Membership of the QCWA; ISSB or similar groups as well as holding DXCC; WAP; WAC or similar certificates all have a points value.

Application for full membership may be made without additional cost as the necessary points are accumulated.

Enquiries from Australian and overseas amateurs are welcome. Send details of the qualifications outlined, or any other considered applicable, to CHC Secretary, Jack Gutcher, VK3APU, 17 Foulds Crescent, Montrose, Vic. 3765. They will be checked and the sender advised of the points and membership level applicable.

To simplify procedures for Australian amateurs, Jack has been authorised to allot points and process applications on behalf of the parent body in the USA.

Initial membership is $3 and subsequent annual subscription is $1.

ACE AWARD

The Australian Commonwealth Electorate Award, recently established by Chapter 66 of the CHC, has become very popular. A number of New Zealand and Australian amateurs have qualified for the basic award — "25 electorates". The first was a New Zealander.

The forecast, that some electorates would be difficult, is proving correct. Particularly some in metropolitan areas. There are odd country electorates which are also proving elusive.

Chapter 66 president, Alex Slight, invites all amateurs to participate. Although contacts may be

SPECIAL OFFER FOR DECEMBER ONLY

20% DISCOUNT ON ALL ORDERS OVER $10.00

NEW RANGE OF RESISTORS CONDENSERS AND POTENTIOMETERS

CARBON RESISTORS

Current type resistors by Philips, IRC, Ducon & Morganite in a wide range of values from 100 ohms to 10 meg ½ and 1 watt
$1.50 per 100 **Post 30c Extra**

MIXED CONDENSERS

The condensers are in most popular brands and include polyester, paper, mica ceramic and electrolytic on values to 8mfd.
$1.50 per 100 **Post 50c extra**

CERAMIC CONDENSERS & THERMISTORS

A large range of current disc & tube ceramic condensers & thermistors.
$1.50 per 100 **Post 30c extra**

POTENTIOMETERS

The pots are all current types and include switch pots, standard pots, pre-set etc.
$1.50 per doz. **Post 50c extra**

POLYESTER CAPACITORS

Pack of 100 new polyester capacitors in 160, 250 and 400 volts working. **$3.50** Plus **50c** Post and Packing.
REGRET SPECIAL VALUES IN RESISTORS, POTS, & CONDENSERS CANNOT BE SUPPLIED.

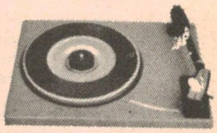
ELECTROLYTIC CONDENSERS

Mixed values in packs of 25 $2.00
Post 40c.

NEW IMPORTED STEREO TURNTABLE AND PICK-UP

3 speed turntable with ceramic stereo pickup counter-balance tubular arm, **$7.90.**
BASE NOT SUPPLIED
240 VOLT AC OPERATION

NEW GARRARD RECORD PLAYER



Three speed turntable with "Sonatone" ceramic pick-up mounted on grey metal base plate with automatic stop.
$15.50. Post and packing NSW — **$1.00;** Interstate — **$1.50.**

NEW ENGLISH AND AMERICAN TRANSISTORS

PACKET OF 18 FOR $2.75

Six of each of the following:
Mazda XA101 Equivalent OC45
Texas 2N1108 Equivalent OC44
Texas 2N1110 Equivalent OC45

PHILIPS VALVE & PICTURE TUBE DATA BOOKS

Hard covered book of over 500 pages covering all modern valves & picture tubes. List price **$4.75** — Special **$1.75.**

BATTERY CHARGER RECTIFIERS

New selenium rectifiers 6 or 12V .4 amp **$2.50.**
New selenium rectifiers 6 or 12V. 2 amp **$1.25.** **Post 50c.**

NEW MINIATURE MOTORS

Ideal for models, toys, etc. 1 ½ to 3 volts, 6,000 R.P.M. 39c each or **$3.50** per doz
Post **10c.**

NEW MIDGET POWER TRANS

40mA prim., 240v. Sec 225 x 225 with 6.3v Fil. Winding.
30mA 240v. Prim. Fil. Winding. **$3.25. Postage: N.S.W. 25c; Interstate 45c.**
150 x 150v Sec. with 6.3v **$3.25. Postage: N.S.W. 35c; Interstate 60c.**

NEW 240V ELECTRIC MOTORS

$4.00 size approx 3 ½ x 2¾ x 3¼ (3300 rpm). Postage **60c.**

SPECIALS FOR PERSONAL SHOPPERS ONLY (NETT PRICES)

NYLEX BELL WIRE 1-028, 300yd reels $2.00.
NEW VALVES. 6U7G or 807 3 for $2.00.
SPEAKERS. 1,000 speakers, new, from $2.00 each.
POWER TRANSFORMERS. from $2.00 (mostly high voltage).
A.M. TUNERS. $3.00 (incomplete).
PORTABLE PLAYER CABINETS $3.00.
PERSPEX PLAYER COVERS From $2.50.
CAR AERIALS. $2.00.
TELESCOPIC AERIALS. 12in extends to 33in 40c.
SPEAKER GRILL FABRIC in blue or gold colour only $2.00 yard.
COPPER CLAD P.C. BOARD. mixed sizes (2sq. ft. approx.) $1.00.
5BPI CRT $2.10.
SMALL TAPE RECORDERS, new, $4.00. Suit hobbyist.

LARGE RANGE OF COMPONENTS AT BARGAIN PRICES

NATIONAL RADIO SUPPLIES

332 Parramatta Road, Stanmore, NSW 2040 Phone 56 7398

made on any amateur band, operation between 3.6MHz and 3.7MHz of an evening will assist ZL stations, as many of them are restricted to the 80 metre band.

For full details write to CHC secretary, VK3APU.

ROSS HULL CONTEST

The Wireless Institute of Australia invites amateurs and short-wave listeners to participate in the 1973-1974 Ross Hull Memorial VHF-UHF Contest.

This annual contest is held to perpetuate the memory of Ross Hull who, through his work and interest in the VHF-UHF bands, contributed much towards establishing their present day use.

A perpetual trophy, on which is inscribed some details of the man in honours, is held for competition between members of the WIA. The name of each year's winner is inscribed on the trophy and that member also receives a suitably inscribed certificate.

Objects: Amateurs located in Australia and territories will endeavour to contact as many other amateurs as possible under the following conditions.

Date of Contest: 1401GMT, 7th December, 1973, to 1400GMT, 20th January, 1974.

Rules:

1. There are two divisions, one of 48 hours duration and the other of seven days. In the seven day division there are four sections: (a) transmitting open; (b) transmitting phone; (c) transmitting CW; (d) receiving open.

In the 48 hour division the best score over any consecutive 48 hour period is the winner.

In the seven day division the best score over any seven days of the contest is the winner. The seven days need not be consecutive. A calendar day is from 1401GMT to 1400GMT.

2. Any amateur operating his station fixed, mobile or portable, within the terms of his licence may participate.

3. All amateur VHF-UHF bands may be used but cross band contacts are not acceptable. At any one time, single frequency operating only is permitted. Cross mode contacts are permitted.

4. Contestants may enter for any one of the sections and either or both divisions. The seven day division winner is not eligible for the 48 hour award.

5. Two contacts per band per day, irrespective of mode, are permitted provided that two hours elapse from the previous contact with that station on that band.

6. Logs from multioperator stations are not acceptable. One operator only may operate a station at any one time and must submit a log for his own operation.

7. Entrants must operate within the terms of their licence.

8. The exchange of RS or RST reports with serial numbers starting with 001 shall be proof of contact.

9. Entries should be set out on quarto sheets, using one side of paper only, and must be forwarded to reach the WIA Federal Contest Manager, GPO Box 638, Brisbane 4001, Qld, in time for opening on Friday 22nd February, 1974.

Envelopes should be clearly marked "Ross Hull Contest". Early logs are appreciated.

10. Scoring will be based on the table shown. Approximate distances are to be shown in the log. Operation via repeaters or translators is not permitted.

11. Logs must carry a front sheet with the following information:

Name.....
Address.....
Section.....
Call sign.....
Claimed 7 day score
Operating dates.....
Highest 48 hour score.....
Operating period.....
I hereby certify that I have operated in accordance with the rules and spirit of the contest:
Signed.....

12. All times to be logged in GMT only.

13. Certificates will be awarded to the winners of each section in each call area. Certificates will be awarded to contestants who break any Australian VHF-UHF distance records. The contestant in a VK call area who returns the highest score in the transmitting section, and who is a member of the WIA will have his name inscribed on the trophy which is held by his division for the prescribed period. A certificate will be awarded to the operator with the highest 48 hour score.

Receiving Section:

1. Short-wave listeners only may enter this section.

2. Contest times and logging of stations will be as for the transmitting section except that there will not be a 48 hour division.

3. Logs must show the call sign of the calling station, the serial number given and the call sign only of the other station. Scoring will be as for transmitting stations.

4. Any scoring contacts may be logged. There is no limit to the number of times that a station may be logged provided serial numbers are given.

5. Logs for any seven calendar days may be submitted and the winner of the section will be the highest scorer.

6. Certificates will be awarded to the highest scorer and, if sufficient interest is shown, certificates will be awarded to the highest scorers in each state.

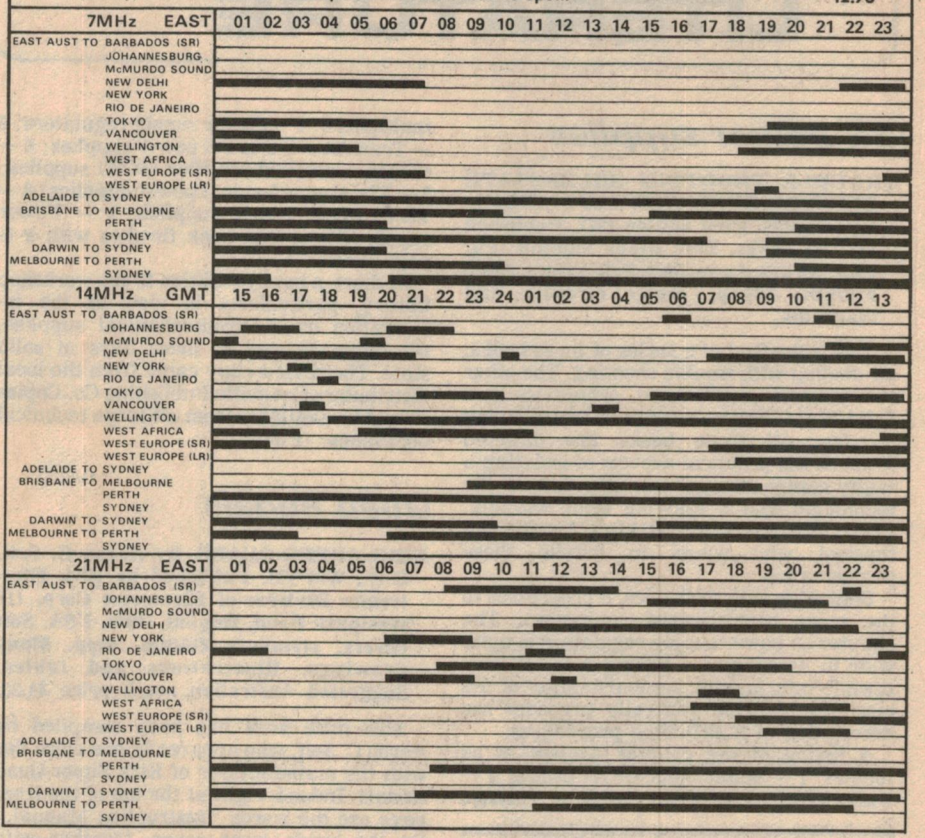
7. A certificate will be issued to the club station with the highest seven day score.

SCORING TABLE

Distance miles	52MHz	144MHz	420MHz	576MHz	Higher
Up to 25	1	1	2	5	10
26 - 50	1	1	5	10	25
51 - 100	5	5	15	30	25
101 - 200	10	10	25	50	100
201 - 300	25	15	50	150	250
301 - 500	20	25	100	250	300
501 - 1000	10	35	200	300	350
1001 - 1500	15	100	250	350	400
1501 - 2500	25	125	300	450	500
2501 - -3500	35	200	400	500	600
3501 - 5000	50	300	450	550	650
5001 and over	100	400	500	600	700

IONOSPHERIC PREDICTIONS FOR DECEMBER

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Commonwealth Bureau of Meteorology. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). Black bands indicate periods when circuit is open. 12.73



General:

It is preferable that complete logs be submitted as an aid to checking but contestants must clearly show their best seven days or 48 hours.

The WIA federal contest manager, Peter Brown, foresees another friendly contest.

CALL SIGNS OF INTEREST

The USSR Antarctic bases have now been allocated call signs with "4K1" prefixes and are as follows: 4K1A — Molodezhnaya, 4K1B — Mirny, 4K1C — Vostock, 4K1D — Novolazareskaya, 4K1F — Bellinghauser, 4K1G — Lenningradskaya and 4K1H — Russkaya.

A maritime mobile station to keep a lookout for is C2-1KM / mm. The operator is Ken McCormack, Radio Officer on the M.V. "Rosie D" sailing between Nauru and Australian ports. Ken's home call sign is ZL1AIH.

QSL cards for contacts with C2-1KM / mm should be addressed to R. K. McCormack, Radio Officer, M.V. "Rosie D", Nauru Pacific Shipping Lines, 327 Collins Street, Melbourne, Victoria 3000. QSL bureaus please note.

BOOKS & LITERATURE

SS power supplies

TROUBLE SHOOTING SOLID-STATE ELECTRONIC POWER SUPPLIES, by Ben Gaddis. First edition 1972. Published by Tab Books, Blue Ridge Summit, Pa, USA, No 619 of a series). Soft covers, 140 x 218mm, 208pp, many circuits and diagrams.

This is the first of a series of three books, all dealing with trouble shooting. The other two concern Solid State Amplifiers and Solid State Wave Generating and Shaping circuits. All three books are directed towards the practical aspects of isolating a faulty component and are intended for the technician who is studying while working. There are many useful hints for the enthusiast who wants to handle these problems too.

Beginning with the basics, it progresses to the more sophisticated equipment. The chapter on power supply regulators is quite wide in its coverage, having a lot of worthwhile information. An explanation of the circuitry involved generally precedes the description of faultfinding procedures.

A listing of the chapter content is as follows: 1 — Semiconductor rectifiers; 2 — Fullwave rectifiers; 3 — Voltage multipliers; 4 — Power supply regulators; 5 — Transistor DC to DC power supplies; 6 — Silicon controlled rectifier (SCR) supplies; 7 — Electromechanical power supplies; 8 — Three phase power supplies; 9 — Power supply filters. The book finishes with a 6-page index.

In short, a handy addition to the workshop library, particularly in view of the information on electromechanical supplies, not often covered in these days of solid state. The review copy came from the local distributors Grenville Publishing Co. Copies should be available from all large technical bookshops. (FJS.)

Quad aerials

KIRK SUPER-QUADS, by Aaron C. Self, E.E., W8FYR. Published by Kirk Electronics Division of Electrotec Corp, 116 Westpark Road, Dayton, Ohio, USA. Soft covers, 140mm x 216mm, 48pp. Many drawings, illustrations and tables. Suggested Australian retail price $4.30.

This little book has been compiled by Aaron C. Self, who apparently has close ties with the manufacturer of Kirk Super-Quad aerials. Indeed, right at the top of the front page are the words "Instruction Manual." On the inside front cover, together with other information is an interesting sentence and we quote: "The information contained herein was compiled from experiments and constructed models to be used as a guide for persons purchasing and assembling Kirk Super-Quad Antenna kits."

Perhaps it may be a reasonable assumption that this manual is supplied with each kit when purchased. In addition to this, Kirk Electronics have seen fit to offer the manual on the open market and it is in this context where our main interest lies.

As hinted earlier, this book is essentially a practical one, giving constructional and adjustment details, with little reference to any theory. The list of contents is quite long but to give the reader some idea of the more salient features, I will pick out what I think will be of most interest.

Quad current and voltage maximums. Quads, Questions and Answers. Gain. Reflectors, Tuned and Untuned. Stringing Wire Frames. Electrical Specifications — 2 El. Quad. Resonant Length Chart — 2El. Quad. Reflector Coils and Stubs. Forty Metre Quad. Multi-Element Quad Arrays. Electrical Specifications — 3 and 4 El. Resonant Length Chart — 3 and 4 El. Matching Methods and Transformers. VHF Super-Quad Arrays.

As may be gained from the foregoing, this little book is packed with practical quad aerial information. If you are vitally interested in this type of aerial, then it could be a useful addition to your library. For a 48 page publication, the suggested price of $4.30 seems rather high. On the other hand, if you are about to build a cubical quad, then the information could be well worth the money.

Our review copy came from Technical Book and Magazine Company Pty Ltd, 289-299 Swanston Street, Melbourne, Vic. 3000, who have copies available from stock. Copies should also be available from other technical booksellers. (I.L.P.).

SS circuit servicing

SOLID STATE CIRCUIT TROUBLE SHOOTING GUIDE, by Art Margolis. Published by Tab Books, publication No 607. Blue Ridge Summit, Pa, USA, first edition 1972. Soft covers, 138 x 215mm, 224pp, many circuits and diagrams. Price in Australia $6.15.

For a serviceman or a technician, wishing to know just a little more about solid state circuitry than knowing what the components look like, this book offers a lot of information.

Beginning with electron and current flow, on through construction and make up of solid state devices, it discusses in an easy manner the properties and background which is sometimes "skipped", in the hurried search for the faulty component. Emphasis is placed on the clear understanding of the operation of solid state devices, to lighten the task of the serviceman.

All the current types of solid state devices are discussed and simple procedures for testing them are provided. The application of the devices in typical circuitry is explained with reasons for choice, alternatives, and possible advantages.

A list of chapter headings will provide an insight to the coverage supplied: 1 — Solid State device construction; 2 — Diodes and bipolar transistors; 3 — FET's; 4 — IC's and SCR's; 5 — RF Amplifier circuits; 6 — IF Amplifier circuits; 7 — Audio and video amplifiers; 8 — Power amplifiers; 9 — Oscillators; 10 — Converter circuits; 11 — Detectors; 12 — Automatic adjustment circuits; 13 — Remote control circuits; 14 — Separator circuits; 15 — Power supplies. An index is provided.

An interesting book and worth a second look. Our copy came to us from the local publisher, Grenville Publishing Co, who advise that copies should be available from all large bookstores. (F.J.S.)

Radio servicing

RADIO RECEIVER SERVICING GUIDE, by Robert G. Middleton. Published by W. Foulsham & Co Ltd, Slough, Bucks, England, 1971 edition. Hard covers, 285 x 220mm, 96pp, many circuits and diagrams. Price in Australia $6.45.

Originally intended for American consumption, this book has been published in UK and bears references for English readers to beware of certain unfamiliar terms used. This should be no problem to local readers who are generally familiar with both types of terminology and presentation.

Commencing with the general requirements for servicing in the way of test instruments, their peculiarities and varied usefulness, the text is then broken up to cover the various sections of receivers in detail. Treatment is quite thorough and a superficial thumb through reveals a good

deal of thought in the presentation of facts without superfluity.

The accent is naturally on solid state circuitry, however a special chapter has been included on restoration of antique receivers, generally expected to be valve versions with some of the early 1930 vintage types shown as examples of the art in those days. The contents cover seven chapters plus a two page index. Very good illustrations are provided and the print is very clear and legible. The type of format employed should be very acceptable for easy reference.

This book is recommended as a reference book and may provide some unavailable elsewhere information, for younger readers unfamiliar with the neutrodynes and regenerative types of receivers of forty years ago. Our review copy came from Grenville Publishing Co. (F.J.S.)

Simplified circuitry

BASIC ELECTRONIC CIRCUITS SIMPLIFIED, by Nelson W. Hibbs. First edition, 1972. Published by Tab Books, Blue Ridge Summit, Pa, USA, No 622 of a series. Soft covers, 140 x 218mm, 352pp, many diagrams and circuits. Price in Australia $7.40.

This book is an attempt by the author to explain in simple terms, those laws and theorems formulated by Kirchoff, Ohm, Helmholtz, and Thevenin, and their application to everyday circuitry.

All this has been done before, perhaps not in quite the same way. But this is a new presentation, with different words, graphs and charts, and may be the answer for the technician who is looking for a refresher course, or information to fill the "gaps" — which become fairly frequent in these days of expanding knowledge. The details are up to date, to the extent that various types of transistors and associated circuitry are dealt with in some detail. A number of other modern circuit problems are also discussed in a clear manner.

A list of the chapter headings will provide some information on the depth of the content: 1 — Basic laws of electronics; 2 — L R C and Time constants; 3 — Diodes; 4 — Analysing time constants of diode circuits; 5 — Amplifier devices; 6 — Amplifier circuits; 7 — Complete analysis of an amplifier; 8 — Frequency response, and operational amplifiers; 9 — More on feedback (oscillators); 10 — Power, power supplies, and safety. An appendix is added, in which there are a number of questions and answers. This is followed by an index of several pages.

Summarising, a handy book to have around for reference.

The review copy came from the local distributor, Grenville Publishing Co. Copies should be available from all large technical bookstores. (FJS.)

Waveforms

HOW TO INTERPRET TV WAVEFORMS by Forrest H. Belt. First edition 1972, published by Tab Books, Blue Ridge Summit, Pa, USA. No 616 of a series. Soft covers, 256pp, 215 x 136mm, many pictures and diagrams. Suggested price in Australia $6.15.

This book is like a family photograph album. You recognise some of the pictures but there are many that represent distant and unknown relatives. The author opens the preface with the remark that some colour TV sets are problems. After viewing some of the possible patterns available you will no doubt agree.

The first two sections are devoted to reviewing the operation of the CRO, how it works and how to handle it in various ways. The accent is then transferred to the application of the CRO as a really specialised tool, to specific problems related to TV sets, colour ones in particular.

The author progresses through the various stages out-lining the fault, method of attack, particular types of connecting probes and leads, the visual response, the difference in the produced response, with sometimes subtle differences, and the method of correction. From the examples provided, it is obvious there is more to it than meets the eye.

Divided into sections, the contents are as follows ; 1 — The nature of waveforms, 2 — Setting the scope for TV waveforms, 3 — A TV set's own waveforms, 4 — Waveforms created by station signals, 5 — Signals for testing colour stages, 6 — Sweep alignment curves for trouble shooting. The contents section may be used as a rough index for locating any of the information sought.

It's a book worth studying, and for newcomers and old hands alike, there are no doubt some tips worth knowing between the covers. Our review copy came from Grenville Publishing Co. Copies should be available from all technical bookshops. (F.J.S.).

Computers

COMPUTER TECHNICIANS HANDBOOK, by Brice Ward. Published by Tab Books, Blue Ridge Summit, Pa, USA, first edition 1971. No 554 of a series, soft covers, 215 x 136mm, 480pp, many pictures and diagrams. Price in Australia $9.95, hard covers $13.60.

This is a book written as a handbook for technicians who, awed by the complexity of computers, are wanting to use their skills in the field of maintenance of these instruments. Some reasonable background in solid state circuitry is assumed and on that basis the text starts off with a general introduction to computers and their systems.

The book is divided into three sections, the first dealing with techniques, circuitry and general details including Boolean algebra, a study of this being necessary in the understanding of computers and their operation. The second section provides a general description of a type PDC808 computer, its operation involving instructions for programming and interface references for readouts etc. The third section deals with the subject of maintenance.

The information is well presented and depicted with many diagrams and circuits. To obtain the most benefit from such a book, it would be most advantageous to have access to a computer or model, to compare the theory with the factual operational experience. The author has gone to some length to provide as much information as possible under the circumstances but practical application of the written word will be necessary for complete understanding.

Some of the subjects covered in the three sections are as follows: First section — Introduction to computers, coding systems, Boolean algebra, basic computer systems, counters, shift registers and memories. Second section — Description of model PDC808, processing instructions, interface and readout references. Third section — Introduction to maintenance, system and functional components, diagnostic information. A five page index concludes the contents.

Written in technician language, however a specialist's book and it is recommended for a serious attempt to service and understand computers generally. Our copy came from Grenville Publishing Co. Copies should be available from the larger technical bookshops. (F.J.S.)

INFORMATION CENTRE

DIGITAL VOLTMETER: I am building the Digital Voltmeter featured in January and February 1973 and am worried about two of the circuit features. I notice that the 3814 outputs to the cathode driver transistors for the FND70 devices do not have limiting resistors. Neither do the outputs a, b, c, d, e, f, and g from the 9307 have limiting resistors. Is this correct? I have worked with other MOS devices and these have needed output limiting resistors. The 3814, in particular, is too expensive to wreck just for the want of a limiting resistor or two. (D.A., Wellington, NZ).

In the mode in which they are used in this circuit, ie, driving buffer transistors, no output limiting resistors are required. When the two devices are supplying current to a load they are essentially current limiting. However, if they were used in a mode where they were "sinking" current from an external source, say the 5V line, then limiting resistors are required. For the 9307, for example, the "sink" current should be limited to 10mA for each output.

TA20B SUBSTITUTE: I am making the Low Cost Utility Guitar Amplifier published in October 1972 (File No 1/GA/19) and want to know if the circuit modification published in November 1972 involving the TA20C thick-film hybrid IC has been found to work well in practice and how do I cut the board to suit the different circuit. (P.K., Belmont, Vic).

The circuit modification published in November 1972 has been found to work well except that the 220uF capacitor connected from pin 9 of the IC to the positive supply should be omitted. The board pattern should be cut as indicated in the diagram on page 130 of the November 1972, using a razor blade or other suitable cutting tool.

SWL QSL's: I have been a SWL for about three years and since the beginning of this year I have been QSLing some amateur stations with about one third success. Is this because I QSL direct or because some stations just do not QSL at all? (J.O., Springwood, NSW).

Your returns would be about average, J.O. In these days, when stations are so numerous, SWL reports are not so sought after by amateur stations. There is the normal response by some but, because of the lack of significant information supplied by some inexperienced SWL's, a reply is felt to be an unnecessary chore by others. To improve your chances of success, ensure that the report carries correct details and as much information as possible that you consider of importance to the station concerned. While listening, take notice of any comments concerning aerials, change in power, modifications to speech equipment, or any tests that may have taken place, and make special comment on them. Remember too that generally, reports are only useful if up to date.

To further increase your rate of success with replies it doesn't hurt to send an "International Reply Coupon" with your reply for overseas stations, or a SAE for local ones that you particularly desire.

You could also join the Wireless Institute of Australia as an associate and be alloted a SWL number. This gives you some minor authority as a recognised reporter, and more importantly, the cost of mailing is reduced to a bulk rate, and handling is done by the Institute's QSL officers.

MULTIMETERS AND INPUT IMPEDANCE: I enjoy reading your magazine and building the projects each month. Lately I have been reading about multimeters and I do not understand what is meant by 20k ohms per volt and 20M ohm input impedance? Another set of abbreviations which are not understood are; Vce, Hfe, and Ft (MHz). What do they mean? I need a 150 ohm earpiece for a project, are such items obtainable and if not what should I do? I also need a small amplifier, 9V type with 50mV sensitivity and ½W output. Can I use an amplifier with 5mV sensitivity and 1W output for the same thing? Would you please answer my letter in the "Information" section of the magazine and thank you for your help with my hobby. (K.A.M., no address).

Thank you for the kind remarks, K.A.M. The term, "ohms per volt" as applied to a multimeter is an indiction of the meter's sensitivity. More precisely, it indicates the resistance of the meter — and therefore the load it will place across the circuit — for each voltage range. The "per volt" refers to the full scale value. Thus, the 20,000 ohms/V meter you mention would, on the 10V range, have a resistance of 200,000 ohms. On the 100V range it would be 2,000,000 (2M) ohms. The term input impedance (as applied to meters) is usually applied to VTVM or DVM type instruments, which usually present the same impedance to the circuit, regardless of the range selected.

Vce, Hfe and Ft (MHz) are terms applicable to transistors, and mean collector emitter voltage, small signal common emitter current gain, and the frequency at which Hfe falls to unity, in megahertz, respectively.

150 ohms is close to a once obtainable type of headphone, but they seem to be unobtainable now. You might try some surplus defence equipment store. If unobtainable, you will have to use a transformer.

Concerning the amplifier, we suggest you use the "Audio Mate" for the project you are working on. The amplifier with 5mV sensitivity is of course more sensitive than the 50mV version, roughly six times. The Audio Mate file number is 1/MA/49, and it was published in March 1972.

DYNAMIC NOISE LIMITER: I recently built the Philips Dynamic Noise Limiter featured in the January 1972 issue (File No 8/AT/35) but am unable to reduce the hiss from my cassette recorder which has a line output of 600mV. I tried adjusting both 4.7k trimpots but without any effect except that at a certain setting I get a very loud sound which I think is positive feedback.

The switch on one side of the diode bridge makes no difference whether it is on or off. I have used type BA219 diodes instead of the BA100 types specified. Is there any way to adjust the noise limiter to do its job? (T.R., Penshurst, NSW).

As pointed out in the article, the Noise Limiter acts only to reduce the hiss component of low level signals. It has no effect on signals above about 50mV rms. If the signal level is consistently too high, as it could be with your deck, the Noise Limiter will have no effect. At the conclusion of the article, we note that for best results, the tape machine needs an output level control to adjust its output to the appropriate level.

LOUDSPEAKER REQUIREMENTS: I am building a Playmaster 132 amplifier/tuner and am not sure what type of speaker to use. As the amplifier produces 40 watts per channel does that mean the speakers must be rated at 40 watts or more? Could you tell me the file no of the Playmaster 132 amplifier please? Congratulations on an excellent magazine, keep up the good work. (S. G., Geelong, Vic.)

Treating your queries in reverse order S.G., thank you for the kind remarks about the magazine. The File No. you require is 1/SA/35 & 36 of June & July 1971. While it appears quite logical to specify a speaker system having the same rating as the amplifier with which it is to be used, it is most important to realise that this does not automatically protect the speaker from overload. The power rating of an amplifier is the maximum it will deliver without exceeding a specified distortion level. It can often deliver a lot more power than this, and the fact that it is distorted won't prevent it from overloading a speaker. The truth is that speakers need to be treated with care and commonsense, regardless of the circuit with which they are used. Much depends on the environment, since it is unlikely that the full 40 watts of an amplifier would be deliberately let loose in the average lounge room. In these circumstances it my be perfectly safe, and a good deal cheaper, to use a speaker with a marginally lower power rating.

HEATSINKS: I am only a beginner and have just built the "Power Pac" (July 1973) and find that it works well. For the heatsink on the BC108 I have fashioned one out of lead. Will this be satisfactory? Why do you always use steel? (M.L., Bentleigh, Vic.)

For a detailed discussion on heatsinks we refer you to the article "Transistor Heatsinks" in the May 1973 issue. (File No. 8/DT/65.) The heatsink you have fashioned from lead will probably be satisfactory since the heatsink requirements of a BC108 are not likely to be very exacting. However, we doubt whether it is a very satisfactory substance, either thermally or mechanically. Being soft, it may not maintain good thermal contact with the transistor, while its thermal resistance is not as low as those metals normally used.

It is not correct to say that we always use steel for heatsinks. In fact, aluminium is the most popular material for this application, having good thermal

HOW TO USE OUR INFORMATION SERVICES

As a service to readers "Electronics Australia" is able to offer: (1) Project reprints, metal work dyelines, photographs, printed wiring patterns and other filed material to do with constructional projects and (2). A strictly limited degree of assistance by mail or through the columns of the magazine. Details are set out below:

PROJECT REPRINTS: These cost 80c per issue-reprint. Thus, a project spread over three issues will cost $2.40. Reprints are available for all projects, but no material can be supplied additional to that already published. Reprints can be supplied more speedily if they are positively identified and not accompanied by technical queries. Material not on file can normally be supplied in photostat form at 40c per page.

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COMMERCIAL EQUIPMENT: "Electronics Australia" does not maintain a directory of commercial equipment, or circuit files of commercial or ex-disposals equipment etc. We are therefore not in a position to comment on any aspect of such equipment.

COMPONENTS: "Electronics Australia" does not deal in electronic components. Prices, specifications, etc should be sought from appropriate advertisers or agents.

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ADDRESS: All requests for data and information should be directed to the Assistant Editor, "Electronics Australia", Box 157, Beaconsfield 2014.

(8/73)

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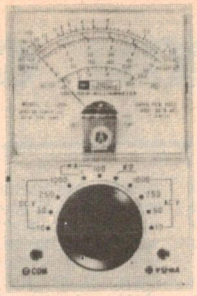

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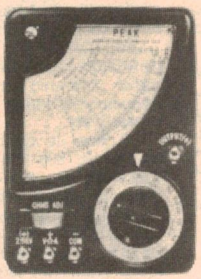

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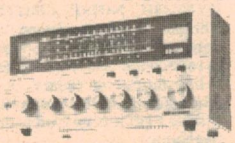

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conductivity, and being reasonably cheap and easy to fabricate. Steel is often used for small "flag" type heatsinks available commercially because it is more convenient to fabricate in these sizes. Since the role is not a demanding one, the somewhat lower conductivity is of little consequence.

CABLE IMPEDANCE: What do you mean when you say a cable has an impedance of say 600 ohms? How can it be 600 ohms for any undefined length? Is it this impedance at one particular frequency, or at all frequencies? Have you published an article explaining these matters, or can you refer me to a book which would do so. (G.G.G., Carlingford, NSW.)

We have dealt with the topic of characteristic impedance at various times, G.G.G., but mainly in passing. it may be time we tackled it once again; we will certainly look at this. In the meantime, the best we can do is refer you to the "Radio Communication Handbook," published by the Radio Society of Great Britain, or the "Radio Amateur's Handbook," published by the American Radio Relay League. Both are available at most of the larger bookstores.

COLOUR TELEVISION: I am going to England this year and will be returning in 1975. I propose to buy a colour TV while I am over there, in England or on the Continent. Would it be compatible with Australian standards? (M.R., Aaranda, ACT.)

It depends on where you buy the set, M.R., as the colour sets from some countries would be very difficult if not virtually impossible to convert to Australian standards. Probably your best bet would be a British set, specifically one fitted with a VHF tuner capable of being re-tuned easily to different channels. You will have to have the sound IF stages retuned from 6.5MHz to 5.4996MHz, but the set should otherwise be compatible. We would suggest that you obtain advice from the British manufacturers before you actually buy a set, just to make sure that you don't find yourself with one having particular problems.

Don't forget that you will probably have to pay a fairly stiff customs duty on the set when you return. This may make the exercise less attractive than at first sight.

PLAYMASTER 136 (December 1972, 1/SA/39): Could you please tell me what is the limiting factor for the total power output of 13 watts per channel for the Playmaster 136? You state that the same power module will achieve 17 watts in the Playmaster 135 with a larger power transformer. If power supply is the limiting factor, might a "larger" power supply give less distortion on the music "peaks" at close to full volume operation; or might this overload the transistor heatsinks or indeed any part of the circuit. B.W., Glen Iris, Vic.)

There are several limitations on the power output from this circuit. The first two are transformer regulation and supply voltage. Increasing the voltage to a maximum of 25, and improving the regulation, allows the amplifier to deliver in excess of 20 watts. At this point the circuit itself and the heatsinks become the limiting factors. The amplifier, as it stands, has only modest heatsinks and these would have to be made considerably more effective and ventilation improved for higher power operation.

CAT'S WHISKERS: I read your article on Crystal Sets and am interested in building an old fashioned crystal set using a cat's whisker. I have been unable to find a source of these, and was wondering if you could tell me where to send my order? (P.J. Hawthorn, Vic.)

Just about the only place you will be able to get a cat's whisker these days is from a cat, P.J.! Seriously, if you require a cat's whisker only, these are quite easy to make using a single strand of copper wire. If, as we suspect, you require a full detector assembly with cat's whisker, crystal and holder, you are probably out of luck. While we heard a rumour some time ago that there was a supply of these devices, we have not been able to track them down. With a little ingenuity and machine tools, you may be able to "roll your own" but we are at a loss as to where you might obtain the galena crystal.

TRANSISTORS — BOO HISS! I think your magazine is great, but don't "dig" your unbounded praise of transistors. I firmly believe that transistors have completely demoralised the electronics industry e.g., the practice of manufacturers selling duds in 44 gallon drums, etc. Low cost batteries you say — but they last twenty hours, performance being very poor compared to a valve portable doing 9 months per set of batteries with 4 hours per day use — so who's kidding who? And I can easily work out a circuit with point to point wiring — but with printed boards find it nearly impossible. Incidentally, I need a replacement transistor for a stereo record player. They are type number 2SB494, and I have looked through 4 substitution books and they are not listed. I have tried AC128's but they give a weak, distorted signal.

Can you help me find a replacement? (H.B. Dunolly, Vic.)

It is you who is kidding yourself, H.B. Let us take your points in turn. Firstly, the matter of "demoralising" the industry. We can see no justification (or evidence) for this statement. In fact, transistors have made the industry as strong as it is today — it is only since the advent of semiconductors that we have witnessed the huge growth and development of the electronics industry. As for manufacturers selling "dud" transistors we know of no company or organisation doing this. Some manufacturers sell their out-of-tolerance (not dud) devices to surplus houses on the clear understanding that they have failed one or more of the very stringent tests laid down for their approval, but this does not make them "duds." If nothing else, this gives hobbyists like yourself the opportunity to experiment with these devices at low cost. At the very least, these transistors will operate as switches, giving you some idea of how they work.

Most of your other comments suggest that you have been confused by the general scaling down in size of radios which transistors have made possible. Take the battery situation, for example. Size for size, batteries supplying transistor radios must last longer than those supplying valve radios, for the simple reason that the transistor sets consume only a fraction of the power needed for a valve set. Granted, when we take advantage of transistors to produce very small sets, we cloud the issue by using very small batteries, and these are always a more expensive way to buy power.

This scaling down also clouds the issue in regard to performance, particularly audio output and distortion. The ultra-miniature set uses, of necessity, an ultra-miniature speaker. These are much less efficient than larger speakers, require more drive from the output stage, and thus cause the set to be driven into distortion if we attempt to get a loud signal from it. The small cabinet and virtual lack of any kind of baffle also place such sets at a disadvantage.

But the point is the people are quite happy to use such sets in many circumstances, simply because they are so convenient. And these sets would not be possible without transistors. If you prefer better performance, and don't mind a larger cabinet, then there are plenty of excellent quality sets around which will perform every bit as well as the old valve sets (better in some ways) and at a fraction of the running cost for batteries.

Incidentally, we cannot help you with your transistor problem — it is probably a house type, as our books do not show it either. We suggest you contact the manufacturers of the set concerned (or their local agents) who may be able to advise you further.

DEAD LETTER: We are holding a letter addressed to Mr T. B. Sharrock, Downer Comstock Construction Camp, Kawerau Bop, New Zealand. This contains reprint material requested by Mr Sharrock, but was returned by the postal authorities marked "Gone. No address." If Mr Sharrock will advise us of his new address, we will forward the material to him.

Continued on Page 126

NOTES & ERRATA

HOMODYNE TUNER: (November 1973, File No 2/TU/37); The junction of the leads from D1, D2, C8, C9, L2 and the positive battery lead should be shown connected (circuit, page 57).

PLAYMASTER 136 (December 1972, File No 1/SA/39-40): A number of readers have encountered a problem in which the main symptom is overheating of the 27 ohm resistor in the emitter circuit of TR12 and/or TR19. This has been found to be due to substitution by certain suppliers of PN4250 transistors for the 2N4250 specified for TR10/TR17. While the PN4250 is elecrically compatible with the 2N4250, the collector and emitter leads are transposed. Without appropriate warning, constructors have been fitting these in reverse configuration.

52-54MHz FM/AM EXCITER (December, 1971, File No 2/TR/49): The trimmer on T4 should be across the primary winding, rather than one side to earth. The 10k bias resistor on TR1 is in error on the circuit and the board diagram should be followed, although either connection would be satisfactory.

MARKETPLACE

DISPLAY ADVERTS in MARKETPLACE are sold by the centimetre from a minimum of 3 cms. to a maximum of 12 cms. Rate $5 per cm per insertion, subject to continuity discounts.
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TAUT Band Multimeter 34 ranges 20,000 ohms/volt AC & DC current to 3A 4 resistance ranges rechargeable battery. Price $24.50 plus tax. Product USSR. Technical & Scientific Eqpt Co Pty Ltd, Box 241E GPO, Melbourne 3001.

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Information — Continued

MIXER PROBLEM: I have been reading Electronics Australia for five years and I find it very interesting. Keep up the good work. Recently I constructed the three channel mixer described in June 1972. It worked immediately and performed well, but after about an hour's use it failed. Can you tell me what could be wrong? Have you ever described an oscilloscope suitable for radio constructors? Is it possible to connect 8 ohm loudspeakers to a 15 ohm amplifier? Would this decrease the output power of the amplifier? (M.H. Kedron Q.)

Thank you for the kind remarks M.H. We are sorry we cannot offer much help with regard to the mixer. We really cannot deduce much from such vague statements as, "It won't go, what's wrong?"

We described an oscilloscope, the "1968 Audio Oscilloscope" in April 1968 (File No 7/C/25.) This should suit your requirements.

In regard to the 8 ohm speaker across the 15 ohm amplifier, once again there is insufficient information. What kind of amplifier? Valve or solid state? If valve, there is little to worry about apart from the academic mismatch, but watch it with solid state types. A lower speaker impedance will normally increase the output, but may well cause the transistor ratings to be exceeded, with predictable and unhappy results.

E-A Guide to Component Suppliers

As a service to readers, Electronics Australia publishes below a list of firms who stock components suitable for our construction projects. Some may specialise in particular types of component, or in kitsets, while others may be comprehensive stockists. For further details about any specific firm, readers should refer to their advertisements.

NEW SOUTH WALES

A.C.E. Radio Pty Ltd, 136 Victoria Rd, Marrickville, 2048. Phone 51 7008.

John Carr Pty Ltd, 405 Sussex St, Sydney (PO Box K39, Haymarket 2000). Phone 211 5077.

Edge Electrix, 25A Burwood Rd, Burwood 2134. Phone 747 2931.

Dick Smith Electronics Pty Ltd, 162 Pacific Hwy, Gore Hill, 2065. Phone 439 5311.

Kitsets Australia (Sydney) Pty Ltd, 400 Kent St, Sydney and 1st Floor, 21 Oaks Ave, Dee Why (PO Box 176, Dee Why 2099). Phone 29 1005, 982 7500.

MS Components, 95-97 Regent St, Redfern, 2016. Phone 69 5922 and 188-192 Pacific Highway, St Leonards 2065.

National Radio Supplies, 332 Parramatta Rd, Stanmore, 2048. Phone 56 7398.

Pre-Pak Electronics Pty Ltd, 718 Parramatta Rd, Croydon, 2132. Phone 797 6144.

Radio Despatch Service, 869 George St, Sydney 2000. Phone 211 0816.

Radio House Pty Ltd, 306-308 Pitt St and 760 George St, Sydney 2000. Phone 61 3832, 211 0171.

RCS Radio Pty Ltd, 651 Forest Rd, Bexley 2207. Phone 587 3491.

Wardrop and Carroll Fabrications Pty Ltd, Box 330, Caringbah, 2229. Phone 525 5222.

VICTORIA

E.D. & E. Sales Pty Ltd, 118 Lonsdale St, Melbourne, 3000. Phone 662 3506.

Imported Components, PO Box 1683P, Melbourne 3001.

Kitsets Australia (Vic)Pty Ltd, 271 Bridge Rd, Richmond. Phone 42 4651.

J. H. Magrath, 208 Little Lonsdale St, Melbourne, 3000. Phone 663 3731.

Radio Parts Pty Ltd, 562 Spencer St, Melbourne 3000. Phone 329 7888.

SOUTH AUSTRALIA

Gerard & Goodman Pte Ltd, 192 Rundle St, Adelaide, 5000. Phone 23 2222.

Kitsets Australia (SA), 50 Grenfell St, Adelaide, 5000. Phone 87 5505.

QUEENSLAND

Kitsets Australia (Qld) Pty Ltd, 293 St Paul's Terrace, Fortutude Valley 4006. Phone 52 8391.

WESTERN AUSTRALIA

Kitsets Australia (WA), 557 Wellington St, Perth. Phone 21 3047.

Willis Trading Co, 445 Murray St, Perth. Phone 217609.

NEW ZEALAND

Kit-Parts Ltd, Post Office Box 27-037, Wellington. Also in Christchurch.

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Index to Advertisers

A-2340R

Can Sidney with his 2-channel tapes find happiness with Marsha and her 4-channel collection?

Yes, friends, yes.

Because TEAC has just introduced the A-2340R. The one deck for two people with different type tapes.

Or the one deck for the family that likes everything.

It's a 4-channel deck with an automatic reverse playback feature for two-channel play.

That's why Sidney can be happy playing his 2-channel collection. He puts on one tape, then doesn't have to leave Marsha for hours. Because when the music from one side ends, the music from the other side begins. Automatically.

And Marsha, with her collection, will surround Sidney in sound. That's the excitement of 4-channel. It's like turning your living room into a concert hall.

But this deck is much more than just a happy ending to a story.

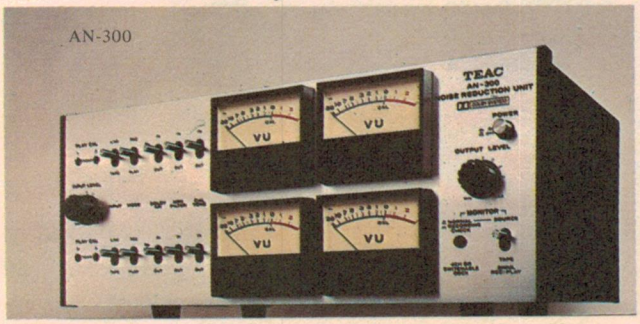
This is one of the finest quality professional-style decks on the market today.

It has three motors. To assure stable and constant tape run. Motors that allow you to fast wind in either direction without tape stretch or breakage.

The perfect partner for the A-2340R is TEAC's 4-channel Dolby* Noise Reduction Unit. Model AN-300. It eliminates tape hiss and other noises that can interfere with the music. This advanced model is built around four separate circuit cards for either playback or recording. You can even use this unit with two 2-channel decks. From what we understand, Marsha and Sidney are getting married soon.

Who said people with different tapes can't be happy?

AN-300



* 'DOLBY' is a trademark of Dolby Laboratories, Inc.

TEAC
The sound of perfection

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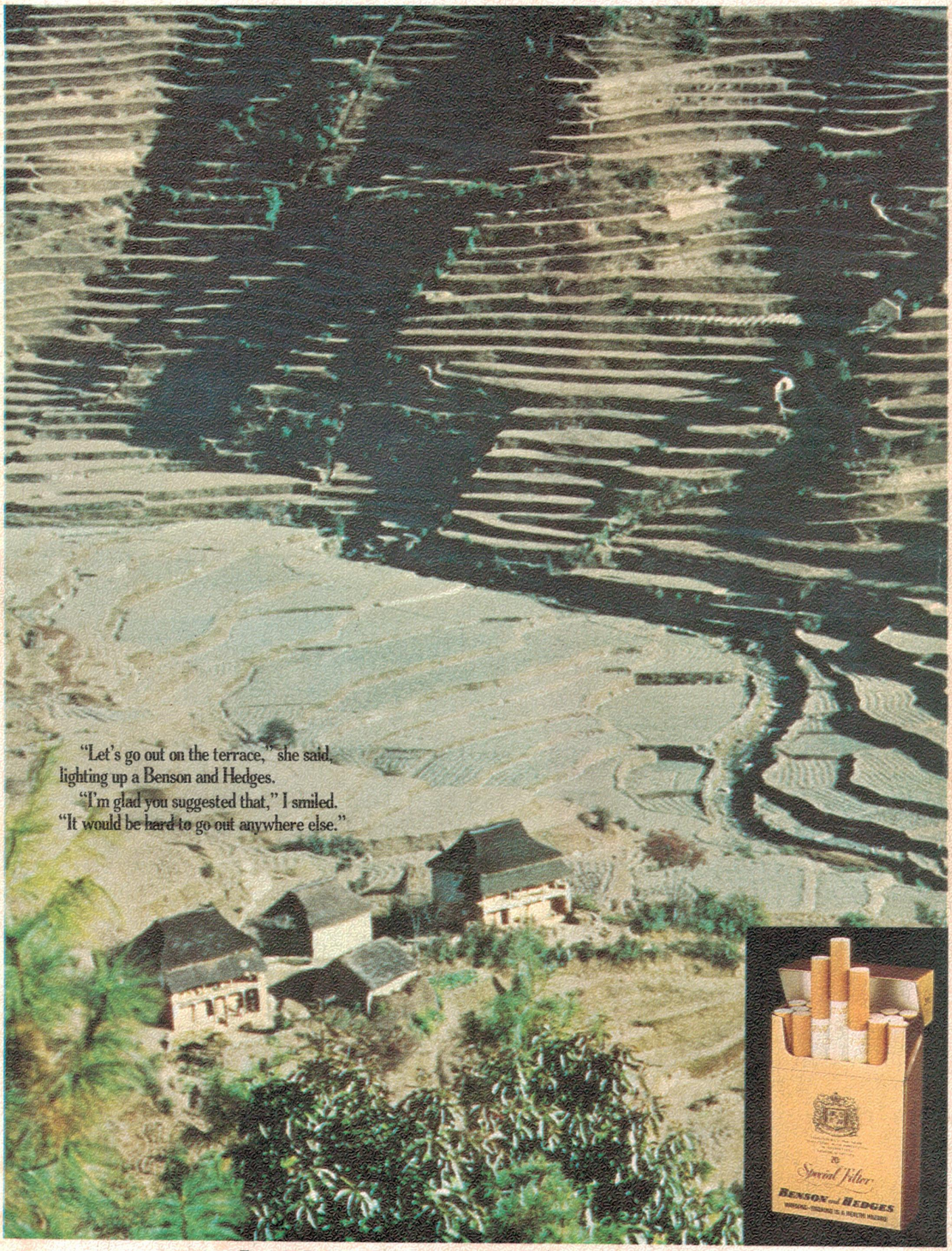

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From the Benson & Hedges Company.

Benson & Hedges Special Filter. When only the best will do.